Agrarian impacts on manufacturing expansion in the Indian Punjab.

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Abstract

The research focuses on the 'controversial' issue of the Green Revolution's spread effects on the manufacturing sector in the Indian Punjab. Significantly, there appears to have been no geographical analyses of sectoral linkages between agriculture and allied manufacturing within the Indian Punjab and few such studies across the Third World as a whole. In this thesis, the key issue that is explored is whether agricultural growth leads to manufacturing expansion or is a dependent sector in economic development. Empirically, the thesis presents a critical examination of development processes primarily at the local level, through an investigation of the Indian state of Punjab. Being a major centre of Green Revolution technological improvement in agriculture in the 1960s, this state provides a important testing ground to see if agricultural growth is capable of producing and sustaining manufacturing expansion. The critical issues are the extent to which the availability of local raw materials from farms has led to manufacturing growth within the state, and the degree to which demand for manufactured agricultural inputs has encouraged industrialists to expand their production (or set-up new production facilities). In format, agrarian impacts on manufacturing expansion in the Punjab have been evaluated by investigating state-level economic performance, temporal connections between production expansion in both sectors, the geographical coincidence of agricultural and allied manufacturing activities, and through a factory-level questionnaire survey on the reasons for plant establishment and expansion, and the strength of links with the farm sector through 'input' and 'output' connections. The experience of the Punjab is that the favourable performance of agriculture has led to spontaneous growth in agro-based industries, but only in certain sectors and largely for small-scale plants. For larger manufacturing units and certain agricultural sectors, government policy weakens or even eliminates growth-related agrarian impacts on manufacturing. Even for those instances in which growth linkages are found, it is evident that government regulation 'allows' them to occur. As a result, it is concluded that the capacity of the agricultural sector to promote (local) manufacturing expansion is significantly determined by government regulation.

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Chapter 1
Introduction

Models of economic growth generally assume that a shift in the balance of an economy from the primary sector toward the secondary and tertiary sectors is a key indication that economic development is taking place. This is despite the fact that, within processes of economic development, agriculture and manufacturing integrate with each other via linkages of production, consumption and savings (Rangarajan, 1982; Ahluwalia and Rangarajan, 1989). Yet many Third World development theorists insist that manufacturing plays the leading role in promoting economic expansion, as capital and labour are held to be more productive within this sector. As such, they argue that agriculture is a dependent sector in processes of economic growth (e.g. Galbraith, 1951; Kaldor 1967; Flanders, 1969). As Schultz (1953, p277) put it: '... It is necessary to emphasise the growing dependency of agriculture upon the rest of the economy'. Challenging the universal applicability of this belief, some analysts have argued that in certain circumstances agricultural investment is the prime source of new income generation in Third World economies and, consequently, is a key feature of development processes (e.g. Johnston and Mellor, 1961; Nicholls, 1964; Rudra, 1972; Reynolds, 1975; Arnon, 1981; Pollard, 1983; Ghatak and Ingersent, 1984; Meier, 1984; Mellor, 1986). As expressed by Lipton (1977, p24): '... a developed mass agriculture is normally needed before you can have widespread successful development in other sectors. If you wish for industrialisation, prepare to develop agriculture'. The accuracy of each side in this dispute is a pertinent issue for poorer Third World nations, given that most have a high level of agricultural employment. In its own right, then, the role of agriculture in Third

World development merits investigation, not only due to its theoretical importance but also because of its practical significance.

The real question is whether agriculture is secondary to manufacturing in promoting economic advancement or if it makes a substantial contribution on its own. Critical to different views on this issue is the achievement of productivity increases. Favouring the view that manufacturing is crucial to economic advancement is the dominant trend in economic growth in the twentieth century, which has seen specialisation in the division of labour enabling more productive economic sectors (e.g. manufacturing) to support the same or a larger labour force. As the classical economists long ago recognised, improvements in agricultural productivity have been achieved largely through the use of manufactured equipment (viz. mechanisation) and through a reduction in the farm workforce, whereas productivity gains in manufacturing have been seen more regularly in increased output (e.g. Ranis and Fei, 1961; Jorgenson, 1967). However, it also has to be admitted that rapid improvements in agricultural productivity can release labour and, from farm profits, provide capital for investment in other sectors, which can be the backbone of manufacturing growth (as seen in the 'Japanese development model'; Johnston, 1966; Hayami and Yamada, 1970; Francks, 1986).

Perhaps, given the potential effects on national economies of rapid advancement in one economic sector, it is no surprise that some analysts argue that it is not necessary for agriculture and manufacturing to grow in a balanced way (Myint, 1975). Viewed in this manner, a country might speed up its rate of economic growth if it focuses its resources on one sector and reduces its emphasis on the other; according to the direction of sectoral comparative advantage. However, as Adam Smith (1930) pointed out long ago, advancement in one sector is not sufficient for national prosperity, for agriculture and manufacturing are conspicuously connected economic sectors, with economic progress being associated with the incidence of improvement in both sectors. Whether explicitly or implicitly, many theorists argue that agriculture and manufacturing should be in some sort of balance if economic development is to be sustained in the longer term (e.g. Youngson, 1959; Seers, 1963; Ohkawa and Rosovsky, 1964; Livingston, 1968). As La-Anyane (1985, p19) put it: 'The complementary relationships between agriculture and industry will promote the structural transformation process and the broader process of overall economic and social modernization'. Put simply, if one sector lags behind it is likely to act as a drain on national resources (perhaps through requiring extra imports to make up for poor domestic production or else failing to provide a market to help stimulate activity in other economic sectors). Even so, while a concentration of economic improvements in one sector might not be ideal, this does not mean that progress has to occur at an even pace in all sectors.

It follows that debate about the role of agriculture in development processes is not concerned simply with relative rates of improvement in agriculture and manufacturing, but centres on whether advancement in agriculture can promote superior manufacturing performance. Historical evidence provides various examples illustrating that this can be the case. Thus, as Jones (1967) and Bairoch (1973) have argued, in the early stages of the European Industrial Revolution, manufacturing expansion was easier in nations that had already experienced substantial increases in agricultural productivity. For example, because agricultural production had risen rapidly in England up to 1830, when manufacturing expansion began to accelerate the nation had sufficient cheap food to feed its rapidly growing (urban) population. In addition, by releasing workers from the land, agricultural improvement made labour available for the expansion of the manufacturing sector (Furtado, 1958; Eicher and Witt, 1964).

Another example of the crucial role that agriculture can play in economic development is provided by the experience of the Soviet Union after 1928. Here government policy deliberately favoured large grain exports in order to pay for imports of machinery and technical aid which were needed to promote productivity improvements in manufacturing (Schwartz, 1950). In a sense, what this deliberate policy sought to achieve was a forced re-enactment of the more spontaneous development experiences of North America in the nineteenth century; where surpluses generated by agricultural exports provided the foreign earnings to pay for machinery and capital imports to promote manufacturing and infrastructural improvements. As articulated in the export-base model of North (1963), this pattern indicates that there are conditions under which agriculture plays a central role in initiating economic growth.

However, as Lipton (1977) instructs us, it would be an over-simplification to assume that, where agriculture is the dominant activity, this sector can be relied on to fuel manufacturing expansion, and hence promote national economic improvements. Quite the contrary might be the case, for Lipton's Urban Bias Hypothesis suggests that urbanisation and industrialisation in the Third World often do not result from farm improvements laying a strong foundation for manufacturing growth, but from government policy strangling agrarian improvement by exploiting the farm sector in order to 'force-feed' urban-manufacturing investment (while also providing cheap food to satisfy urban consumer demands). In pursuing this tactic, governments are adopting manufacturing-led models of economic development that are drawn largely from theorists in the advanced economies. However, serious question marks can be raised over the appropriateness of transferring theoretical ideas from the advanced economies into the Third World.

Developed Versus Under-Developed Nations

In Lipton's Urban Bias Hypothesis, he argued that theories of economic growth that have been developed in the advanced economies can act as barriers to economic growth in the Third World (see also La-Anyane, 1985). As such, he joins numerous other theorists who doubt the wisdom of transposing theoretical ideas based on the past experiences of advanced economies onto the present-day Third World. Thus, both Myrdal (1957) and Kuznets (1958) have noted that the Third World nations of today exist in an environment whose problems and prospects are quite different from those faced by the advanced economies in the eighteenth and nineteenth centuries. In particular, they point to notable restrictions on the political and economic independence of less developed nations to pursue their own national priorities (viz. pressure from advanced economies to keep markets open to imports), as well as characteristically having more rapid rates of population growth and higher population densities than European nations in earlier centuries. This last point has also been made by Williamson (1989), who compared the socio-economic and demographic conditions of Third World nations between 1950 and 1970 with the situation in nineteenth century Europe (1830-1900). Analysing birth rates, death rates, urbanisation trends, and the contributions of agriculture, manufacturing and services to the labour force and to national income, Williamson found that the population burden of nineteenth century Europe was much more modest than that of the Third World today.

Whether fundamental differences exist between developed countries and Third World nations or there is only 'one world' as Auty (1979, 1995) suggests, it is important to recognise that there is much variety under the heading 'Third World'. Indeed, various nation groups can be recognised within the Third World. One of the most distinctive of these are the Newly Industrialising Countries (NICs), where economic growth over the past 40-50 years has been distinguished by an export-led growth model of manufacturing and agribusiness production. Most commentators have included Hong Kong, South Korea, Taiwan and Singapore amongst the NICs (Browett, 1985; Harris, 1986), although some would add nations like Mexico and Brazil (Frank, 1982).

Of course, Third World nations may be differentiated by various criteria, like income, population size, pressure on physical resources or the adoption of different development strategies. Even in official circles, such divisions are recognised, as seen in World Bank classifications that identify distinctive economic prospects and problems within the Third World (World Bank, 1992). Moreover, commentators accept that the effects of development policies vary even within the regions of a single country (Johnston and Clark, 1982). It follows that it is important to be aware of differences across Third World nations when conceptualising linkages between agriculture and manufacturing. This applies particularly to acknowledging potential differences between nations of low income, whose economies are dominated by agriculture, and countries with relatively superior resource endowments, which have revealed a capacity for rapid export-led growth in their manufacturing sectors (e.g. the NICs).

The impact of agrarian improvement on manufacturing growth (and on an economy as a whole) is likely to vary across such nation-types. This thesis is not intended to address such differences. Rather it focuses on a low-income setting (India), in which agriculture is the dominant employer of labour. It asks whether, in this context of development need, agrarian improvement does stimulate manufacturing growth.

The practical significance of this issue in low-income agrarian settings arises from the suggestion that improvements in agricultural productivity are more inclined to have an effective impact on economic advancement. The reasons Kuznets (1961) gave for this are grounded in the notion that, where agriculture is dominant, it has the potential to make a substantial direct contribution to development by: (a) increasing supplies of food and raw materials for manufacturing, and so promoting opportunities for expansion in nonfarm sectors, as seen in the creation of service jobs to support farm production and farm household consumption, with this kind of effect termed the product contribution of agriculture; (b) increasing demand by the agricultural population for the products of domestic industry, whether for farm production or for household consumption (the market contribution); and (c) providing capital from farm profits that, through the banking system or through family and social support networks, offer funds from which entrepreneurs and governments can finance investment in infrastructure and manufacturing (the factor contribution). A further contribution was added to this Kuznets list by Johnston and Kilby (1982), who argued that agriculture can earn foreign currency either through production for export or agricultural import substitution, which then allows other sectors to import new technologies to improve their production.

In part, of course, the opportunity to take up prompts from agrarian expansion will be affected by the capacity for improvement in other economic sectors. If agriculture advances but other sectors are incapable of taking up the resulting challenges, then opportunities for economic advancement will lost. This reintroduces the point that economic expansion is best served if agriculture and manufacturing are able to progress in tandem; that, in an ideal world, there should be no conflict between the two, as they have complementary development roles.

What might also be suggested is that the positive benefits of agricultural improvement will be best achieved where there is a tradition of entrepreneurship; or, put another way, a business climate that increases the prospects of people grasping opportunities from agrarian expansion to promote economic improvement in other sectors. In this regard the state of Punjab in India provides an ideal 'laboratory' in which to explore the question of whether agricultural expansion is capable of promoting and sustaining development in manufacturing (or, indeed, in other sectors of the economy).

The Indian Punjab

In an international context, the Punjab is an appropriate site for this investigation on account of the low (relative) incomes and substantial agricultural employment that is found here and in India as a whole; both point to the theoretical and practical benefits that could be obtained from assessing potential gains from agrarian-led economic growth. The Punjab also has a special place in the history of agricultural development, in that it was one of the first places to experience rapid farm production increases resulting from the introduction of Green Revolution technologies. Lipton and Longhurst

(1989), for one, have argued that amongst the lower income areas of the world the Punjab has consistently been at the cutting edge of technical change in food production. This state is certainly regarded as the heartland of the Green Revolution in India (Chadha, 1985). Yet agrarian expansion in the state has not led to the 'traditional' pattern of massive reductions in the farm workforce; which many see as a key to economic development, given that this releases labour for manufacturing (Lewis, 1958; Ranis and Fei, 1961). On the contrary, demand for farm labour within the Punjab continues to be high, with workers having to be attracted from other states of India in order to meet the needs of the farm sector (Hanumatha, 1974; Johl, 1975; Grewal and Sidhu, 1979; Pollard, 1983; Chadha, 1986; Rudolph and Rudolph, 1987; Sharma and Dak, 1989; Bhalla, 1990; Bhalla et al, 1990; McGuirk and Mundlak, 1991). At the same time, increases in the real wages of agricultural labourers are a feature of economic change in the Indian Punjab (Griffin and Khan 1978; Bhatia, 1988).

Adding further to its suitability as a research site, the Punjab has a strong entrepreneurial tradition, which some commentators have associated with the values of its Sikh population (Leaf, 1987). Hence, if agrarian-led development has prospects for success, then the Punjab is well placed to give a lead in such processes. Furthermore, establishing whether agriculture does have this effect is an important research task; not simply because this prospect offers hope for other agriculturally-dominated low income areas but also because, more generally in the Third World, if agriculture can have this effect, then this should provide a solid base from which economic expansion in other sectors might be promoted.

However, as a reading of the literature quickly reveals, in reality there is little empirical evidence that supports the view that agricultural improvements in the Punjab have laid a firm foundation for expansion in other economic sectors. Too readily, it seems, writers have assumed that the temporal coincidence of production growth in manufacturing and in agriculture has been brought about by causal connections. With regard to this issue, a long list of analysts, including Pollard (1983), Gosal and Krishan (1984), Chaudhri and Dasgupta (1985), Chadha (1986), Gill (1988) and Bhalla (1975, 1990), have argued that, since the onset of the Green Revolution, growth in agriculture and manufacturing in the Punjab has been strongly linked. On the other side, an equally long list of researchers, including Aulakh and Raikhy (1980), Sandhu and Singh (1983), Leaf (1984), Kainth and Bawa (1985), Alam (1987), Azad (1987), and Singh (1987), have asserted that the linkages between them are weak.

In truth, on both sides, much of the commentary that exists is based on assertion rather than being grounded in an empirical evaluation of the character and strength of linkages between the two sectors (Westley, 1986). Although Ghosh (1977, p123) made the point 18 years ago, little has happened since to alter the conclusion that: 'No systematic study has yet been made to fully examine the impact of the green revolution on industrial development in the Punjab region. This may be partly due to the extreme difficulty in obtaining the wide range of statistical information'. It follows that the extent to which farmers provide a market for the sales of Punjab manufacturers is not known. Neither is the extent to which the Punjab's manufacturers rely on, or are persuaded to expand their production by, agrarian inputs from within the state. It is no surprise, then, that there is a division of views about whether agriculture and manufacturing in the Punjab are tightly connected or largely independent. This thesis seeks to address one of the 'holes' in this debate, by providing an empirical evaluation of the impact of agricultural activity on manufacturing expansion.

Thesis Structure

To meet the objectives of this study, the next chapter is designed to highlight the theoretical questions that relate to the role of agriculture and manufacturing in development processes. The aim is to pin-point the dominance of manufacturing-led views of development processes and to highlight contrary views on the role that agriculture has in promoting economic growth. The objective in presenting these theoretical positions is to contextualise the study that has been undertaken, as well as to point to key issues in debates on the role of agriculture in economic growth. With this in mind, the chapter starts with views on development processes at an international level. For this, a number of 'core-periphery' models are used to illustrate how theoretical ideas tend to divide the world into core manufacturing economies and peripheral agricultural economies, with change in peripheral economies being dominated by manufacturing-led growth that originates in core economies. This point is taken further by an examination of the operations of multinational corporations, which have influenced agricultural change in peripheral countries via the Green Revolution and agriculturally-based manufacturing enterprises. The second section presents the theoretical views of dualistic development models. These models point out that manufacturing is the prime mover in economic development and that basic resources for economic development are acquired from the agricultural sector. However, doubts about the merits of this interpretation of economic advancement are raised in the third section, in which the Urban Bias

Hypothesis is examined. This hypothesis recognises that manufacturing growth often occurs more rapidly in the Third World than agricultural change but explains this as resulting from deliberate government policies. How these various theoretical ideas can be evaluated empirically is examined in the fourth section, where methodological approaches to identifying linkages between agriculture and manufacturing are examined. This discussion will assess the strengths and weaknesses of various methodological approaches, so as to position the analytical approach of this thesis in a broader context.

Having set the theoretical scene for the investigation, Chapter Three introduces the empirical setting of the Punjab within India. Analysis is undertaken from 1966/67, which was the year of arrival of the Green Revolution in the Punjab, as well as being the formation year for the new Punjab (before 1966, Haryana state and some parts of Himachal Pradesh were part of the former Punjab). As India is a diverse economy and Punjab is not a closed economy, it is pertinent to evaluate trends in agricultural and manufacturing change amongst the states of India, for improvement in one state's agricultural performance could have spin-off effects for manufacturing activity in another state, rather than agricultural and manufacturing growth occurring simultaneously in each state. A temporal analysis of change in state-level production output for agriculture and agriculturally-based manufacturing is undertaken, to see if those states which are at the forefront of agricultural growth are also leaders in agriculturally-based manufacturing. In addition, if we are to understand growth linkages between agriculture and manufacturing, it is necessary to assess the support structures of these sectors. Consequently, general economic growth trends will be examined to see if this is linked to differential rates of progress in both the agricultural and manufacturing sectors. Given that national development policies in India have centred on planned development programmes (viz. national Five Year Plans, agricultural and industrial policies), the discussion will also focus on the role of National Plans in promoting agriculture and manufacturing at the state level.

This is followed in the fourth chapter by an examination of temporal changes in agricultural and manufacturing production within the Punjab. This investigation will show whether agricultural growth and manufacturing expansion have occurred together or whether one of these sectors increased its output earlier than the other (so it can be viewed as having taken the lead in production gains). In addition to this, the state government's efforts in seeking to promote growth in these sectors will be analysed, to see if the state has given equal preference to promoting expansion in agriculture and manufacturing, or if one sector has been favoured over the other in terms of public investment.

Following the temporal analysis of agriculture and manufacturing in the fourth chapter, Chapter Five presents a more explicitly geographical picture by evaluating the spatial coincidence of agricultural and manufacturing activity within the state. This spatial analysis will examine the geographical co-existence of agricultural growth and manufacturing expansion in the state. By asking if those areas that have increased agricultural production are showing greater manufacturing output, we can evaluate whether areas with a high agricultural output and a strong manufacturing performance co-exist or whether the geography of production in one sector occurs irrespective of the geography of the other sector (this chapter will focus particularly on the location of farm output processors and agricultural input manufacturers). This analysis will focus on the administrative districts of the Punjab, for annual data for manufacturing are only available for districts in the state (and not for more local level units like tehsils or blocks), and data are also available at this level which enables us to identify the leading districts in crop production.

The third, fourth and fifth chapters take different perspectives to give a broad idea of the impact of agricultural activities on manufacturing expansion in the Punjab. However, these analyses will not tell us whether the Punjab's farmers are selling their produce locally, nor will they tell us whether they are buying their farm inputs from inside the state. On the other side, these chapters cannot tell us if agriculturally-based manufacturers are selling their end-products locally or whether they buy their material inputs from within the state. Whatever the case may be, it is extremely difficult to investigate directly whether farmers sell produce locally or buy inputs from within the state. A primary reason for this is that farmers sell much of their produce to procurement agencies or commission agents, and buy many of their farm inputs through retailers and co-operatives. On the farm produce side, commission agents are free to sell this produce all over India and government agencies can allocate their materials to any part of India. On the farm input side, chains usually exist for farm input supplies. Some of these chains are comparatively short, as for fertilizers, which are mainly supplied by cooperatives, whose allocations are controlled by national and state governments, with relatively few fertilizer plants in the nation as a whole. Other chains are much more complex, so that to trace the real origin of manufactured farm inputs, you would have to start with retailers, go back to their wholesale suppliers and from there investigate the distributors and manufacturers from whom they obtain products for sale. This chain could end in Punjab or in a neighbouring state or in any other state in India. To make the present empirical investigation more feasible, and avoid long circuitous links in farm produce selling and farm inputs buying, the approach adopted was to question manufacturers about their input purchases and their output destinations. The material for this is presented in the sixth chapter, which offers an analysis of questionnaire returns from manufacturing plants. For this analysis sectors dominated by small-scale manufacturing plants were chosen, from which the responses of 80 rice shelling factories are examined to assess farm output linkages into manufacturing, alongside 95 agricultural machinery factories, which were investigated to assess input supplies to farms. One particular advantage of analysing these manufacturing sectors is that government control over small-scale manufacturing is limited. As such, these questionnaire surveys can identify whether growth and product specialisation in manufacturing plants are linked to the demand pattern generated by growth in agriculture.

In the conclusion to the thesis, it is recognised that the combination of empirical evidence presented does not cover all possible approaches for the investigation of growth linkages. Nevertheless, it is argued that drawing together materials on factory-level linkages, on the geographical coincidence of agricultural and manufacturing activity, on temporal connections between expansion in both sectors and on state-level performance, provides a solid base for evaluating the role of agriculture in promoting a sustained pattern of manufacturing growth. Drawing together the lessons of these separate approaches and using them to re-evaluate theoretical perspectives on agriculture-manufacturing growth linkages is the task of Chapter Seven.

Chapter 2

Agriculture and Manufacturing: Theoretical Perspectives

Development is a multidimensional process involving the reorganisation and reorientation of economic and social systems (Todaro, 1989). However, in studying development, each of the social sciences has constructed their own theories that provide particular interpretations of the concept of development, as well as having specific emphases in approaching its measurement and gauging its processes. In addition to interdisciplinary divergence in causal emphasis, theories also differ in terms of their practical orientation. Indeed, to get a better understanding of the causes and effects of development, several theoretical approaches often have to be adopted for the analysis of development processes. In this chapter the development concepts that particularly interest us are those that draw attention to agriculture-manufacturing relationships. These will be investigated here, first, by examination of those theoretical ideas that are related to general processes of development and then, more particularly, by reference to alternative approaches to the empirical evaluation of these linkages.

In the first section of this chapter, attention is directed at development processes operating at an international scale. Here, as illustrated by 'core-periphery' models, it will be shown that theoretical ideas divide the world into core economies that are more dominated by manufacturing production and producer services, and peripheral economies that are more dominated by agricultural production and consumer services. Empirical evidence on the operations of multinational corporations and, as a sub-part of those operations, their role in promoting Green Revolution technologies, emphasise that manufacturing drives change in agriculture, rather than vice-versa. This view is also found in development models with a more national or even local orientation, as seen in dualistic development models. Examination of such theoretical positions forms the centre of attention in the second section of this chapter. Here, emphasis is placed on low income countries, in which these theories envisage agriculture occupying a subservient position in development processes. This view is questioned in the third section of the chapter, in which the Urban Bias Hypothesis is presented, which stresses that the seeming strength of manufacturing owes much to biases in government policies. Having reviewed theoretical arguments, it will be clear that there is still a need for detailed empirical research to teases out the character of agrarian impacts on broader development processes. How this can be achieved in methodological terms will be examined in the fourth section. Here, various methodologies that can be used to evaluate agriculture's role in economic progress, and particularly its links with manufacturing, will be explored. From this, the approaches adopted in this study will be outlined and justified; thereby placing the evaluation undertaken here in a general methodological context. Having discussed the relevant methods to be used for this empirical analysis, the Punjab is returned to, in order to review the various approaches and conclusions that have been reached on the strength of agriculture-manufacturing linkages in the state.

'Core-Periphery Models'

Theoretical ideas presented by Paul Baran (1957), Andre Gunder Frank (1969) and also the work of Immanuel Wallerstein (1979) shared the notion that, as a result of dependency, unequal exchange or global class relationships, capitalist development leads to some places being 'continuously' (relatively) advantaged in development processes, while other parts of the world experience absolute or relative underdevelopment. Thus, Baran (1957) argued that the main global economic problem was the role of monopoly capital and imperialism in the advanced countries, with economic and social backwardness in less developed countries being intimately related to these advanced economy processes. On similar lines, in his core-periphery model Myrdal (1957) portrayed less developed regions as the 'periphery', in which an initial absence of capital leads to low investment and therefore to low productivity. This in turn results in low savings, inadequate capital accumulation and a low level of technology. These conditions generate 'regional' income inequality, which is heightened by the actions of 'core' industrial areas, whose economic power gives them the opportunity to exploit backward areas as a market for their manufactured goods and as a cheap source for the raw materials they require. According to Hirschman (1958), 'unequal growth' results in a division of the world into developed and underdeveloped nations with splits in single countries into progressive and backward regions. How this works out in the longer term is the subject of theoretical dispute. For Hirschman 'trickle down' effects occur at both international and national levels, so the benefits of growth in core regions are passed on to the periphery. However, in the context of the international economic system, Frank (1969) asserts that the capitalist system perpetuates inequalities, for it generates underdevelopment in 'peripheral' satellites (e.g. Third World nations) by taking away their economic surpluses, to 'feed' economic development in 'metropolitan' centres (i.e. the advanced economies). In this view, what is central to the dominant position that is held by core economies is both their political power and their economic strength.

The latter is significantly dependent on technology and manufacturing capacity, which provides a major economic advantage over primary and tertiary sectors owing to a faster rate of increase in value, which further sustains and enhances economic and political power.

In essence, it is argued that economic expansion in the less advanced economies is directly dependent upon economic trends in higher income regions. Peet (1987) adopted this theoretical structure when arguing that the development of core regions was predicated upon the underdevelopment of peripheries, both within capitalist countries, and between advanced economies and the Third World. He illustrated this by reference to the Third World debt crisis, which he argued was an export from the First World, with the debt problems of the Third World being created through the industrial and financial dominance of advanced economies within the global economy. Hence, while the ability to repay foreign loans has depended largely upon the export of raw materials, fuel and manufactured goods from the Third World (to core economies), it is the core economies that dominate the organisations that establish and police terms of trade and financial transactions, with the result that Third World nations operate in a market or trade system that favours the core.

A geographical basis for this model has been formally presented by Wallerstein (1979), in his division of the world into core, semi-periphery and periphery; with the appropriation of surplus said to flow from peripheral areas, which are dominated by producers operating in a low wage, low profit and low capital intensive environment, to the core, where producers operate with high wages, high profits and a high level of capital investment. For Wallerstein, the 'core-periphery' approach involves a framework centred upon a capitalist world economy, with development within states or countries being dependent upon their position in the world economy (so seen in isolation states are inappropriate units for studying economic change). In supporting Wallerstein's approach, Taylor (1993) argued that one of its key strengths, compared to other theories, lies in its longer temporal perspective, which signifies the enduring character of dominant economic relationships and challenges assumptions of rapid change that are found in developmentalism (the transition from underdevelopment to development in terms of a series of steps or stages through which all countries proceed; for instance, as captured in Rostow's stages of growth; Rostow, 1960).

The above 'core-periphery' models are mainly concerned with global patterns of change under conditions of capitalist economic growth, rather than offering direct insights on the role of manufacturing and agriculture in development processes. Indeed, only a few studies that might be placed within this tradition focus on agriculture as such. One important analysis that is in sympathy with the World Systems view is that of Peet (1969). He used von Thünen's model to interpret the spatial expansion of commercial agriculture in the nineteenth century, looking particularly at change in the places that supplied Britain with food and agricultural raw materials between 1800 and 1914. He pointed out that, just as von Thünen suggested that growing demand in a central market was crucial for the spatial expansion of agriculture at the local level, so too did the growth of manufacturing in Britain provide the essential driving force for the commercialisation of agriculture in what was then the periphery of the 'global' capitalist system. In terms of agriculture-manufacturing linkages, this von Thünen interpretation captures the essence of the 'core-periphery' view that core economies dominate economic change in less developed areas and, by implication that changes in agricultural production are generated by demands from manufacturing (particularly in core economies).

Multinational Corporations

Providing a broader interpretation of the same processes at the international level, the literature on multinational enterprises in the Third World also emphasises the secondary role of agriculture. However, the role of multinational corporations in the Third World is surrounded by controversy, even though a variety of interpretations exist on their activities. Some emphasise their positive benefits, with attention drawn to technology transfers and the benefits of new investment or management practices (e.g. Vernon, 1977), and others adopt a critical approach, stressing the economic disadvantages that result from multinational corporate operations in poorer nations that cause underdevelopment through a massive drain of economic surpluses and a loss of political (and economic) autonomy (e.g. Jenkins, 1987). Peet (1982), for instance, blamed multinationals for cultural imperialism, and for introducing unnecessary products into the Third World. Likewise, multinational corporations have been criticised for promoting undesirable concentrations in the industrial structures of poor nations (Corbridge, 1986). As expressed vividly by Frank (1969), multinationals are not agents that promote development but are instruments of exploitation and underdevelopment. Contradicting this view, other researchers have emphasised that multinationals play a major role in expanding manufacturing capacity and in transferring manufacturing technology that helps promote beneficial industrialisation in the Third World. From this perspective, multinational enterprises are one of the principal engines for world economic growth (United Nations, 1973; Helleiner, 1975; Vernon, 1977; Dunning, 1985; Goodman, 1987). As in the case of Brazil (Raj, 1975), Kenya (Kaplinsky, 1978) and Hong Kong (Chen, 1981), there is evidence that where manufacturing is a leading economic sector with high rates of production growth, this is due in good measure to direct foreign investment via multinational corporations. (This is not to say that multinational enterprises are solely involved with manufacturing activity, for some are also major landowners and agricultural producers. However, the mainstream involvement of multinational enterprises in the Third World, especially in terms of conceptualisations of their impact on economic change, focuses primarily on their manufacturing contributions).

However, in examining multinational enterprises as an element of Third World economic change, the aim in this chapter is not to evaluate their impacts in general terms. Rather the intention is to identify what investigations of multinational corporations tell us about the role of agriculture and manufacturing in Third World development. In the following section, therefore, the focus of attention is on the role of multinational corporations in changing agricultural production and in assisting in the adoption and spread of Green Revolution technology in Third World nations. Here we will see that most stress has been placed on the notion that manufacturing motivates change in agriculture.

Multinational Corporations and Agricultural Change Many analysts have conceptualised linkages between multinational enterprises and agriculture in the Third World in terms of creating off-farm job opportunities, facilitating access to foreign markets and developing domestic agro-processing industries (Ghersi and Rastoin, 1981). In addition, another agricultural tie is observed in the 'Core Satellite Model' (Goldsmith, 1985; Karen and Williams, 1985). In this model, corporate food processors are said to enhance local development opportunities through a link-up with small farmers via production contracts, which assist the farmer by providing start-up loans and technical assistance in return for assured deliveries of produce to the factory. Williams (1985a) offers one example of this, in reporting on Productos Del Monte, the vegetable and fruit canning corporation, which established production in Mexico in the 1950s. Here supplies of raw materials came from small-scale contract farmers, with the multinational company investing in irrigation and transport facilities, so that the factory had an impact on the agricultural economy of central Mexico that was broadly beneficial. Eccles and Fuller (1970) provide a similar example from Portugal, which, at the time, had sufficiently low farm incomes that it shared many features with some Third World economies. Here, the Heinz Company promoted tomato production on small farms, by introducing new high yielding varieties, appropriate fertilizers and pest control practices, and made credit available for farm improvements, in order to secure an adequate quantity and quality of inputs for its new tomato processing plant. As in the Mexican case, we find significant economic gains accruing to the local area, through new employment creation, increased export earnings and greater mechanisation. As Helleiner (1975) and Ghersi and Rastoin (1981) have noted, this kind of multinational investment in agriculture not only creates jobs and facilitates access to foreign markets, but also improves domestic food provision. This point has also been made in a report on global food and beverage processing by the United Nations Centre on Transnational Corporations (1981), which noted that the food processing industry is important not simply for the provision of off-farm employment, but also for linked commercial and manufacturing developments in the Third World.

One aspect of this is seen in Hindustan Lever's milk plant in India (this firm being part of Unilever), which promoted the introduction of new cash crops, such as oil seeds, when it introduced oil extraction activities into its plant (Karen, 1985a). The same point has been made by Williams (1985b), who noted how multinational corporations have introduced new crops into Kenya to supply their own new manufacturing plants. The Mumias Sugar Company, which was established in 1972, is an example, as it took land (on lease) from the Government of Kenya and issued contracts to local small-scale farmers to provide the input needs of the factory. The end result is that it has provided benefits to a large number of small farmers in the surrounding area, although sugar-cane was not grown there before the arrival of this company. A similar example is provided in Nestle's milk processing plant in the Indian Punjab, where all milk collection agents are farmers, and where Nestle's increased demand for milk has brought significant financial gains for smaller farmers (Thaper, 1991).

But while an important element of multinational involvement in the Third World is agribusiness investment in local food processing (Todaro, 1989), not all multinational corporate effects come through manufacturing. Often controversially, multinationals also have a direct impact on farm production, and through this on economic development and social well-being. Investment through the purchase of land and the development of plantation agriculture provides one such example, as in the Philippines, which has become one of the world's major exporters of bananas due to multinational investment (Knox and Agnew, 1989). However, multinational firms have often not acted in isolation in producing this effect. Thus, when plantations were established in Kenya in order to export cotton and flowers to Europe, a key factor in attracting this multinational investment was Kenyan government policies which kept agricultural wages low (Jorgensen, 1975). More generally, demands for foreign currency that are needed to support manufacturing growth or make debt repayments have often resulted in Third World nations changing their agricultural land utilisation patterns in order to introduce industrial crops and luxury foods for export to richer countries. Jacoby (1975) offers evidence on the role of multinational firms in this process; as in the Awash Valley of Ethiopia, where cotton and coffee plantations were expanded at the expense of domestic grain production.

Multinational Corporations and the Green Revolution A potent example of how Third World agriculture has been significantly changed by the actions of institutions in advanced economies is found in the introduction of Green Revolution technologies. The history of the spread of this new seed-cum-fertilizer technology offers a clear picture of multinational involvement in Third World agricultural change, although it also brings into focus the role of national governments in encouraging, supporting and helping sustain such changes. According to Goodman and Redclift (1990), the spread of Green Revolution technologies should be seen as part of a global dissemination of an agro-industrial model, where farming is tied and directed by manufacturing corporations on a growing scale. However, this does not mean that multinational manufacturing corporations were the prime movers in this diffusion process. In some cases they undoubtedly were; as when the San Miguel Corporation promoted high yield hybrid corn seeds in the Philippines, so that small-scale farmers could buy their seeds and sell their grain to the company for processing (Karen, 1985b). In Northern Rhodesia (now: Zambia) also, hybrid maize was adopted by commercial farmers due to pressure from the Copperbelt Mining Company, as this firm wished to see greater agricultural production in order to generate cheaper supplies of maize for its workers (Pearse, 1980).

However, there have been other significant agents in the promotion of Green Revolution technologies in the Third World. In Nigeria, for example, the World Bank was a major external influence on agriculture, even though the national government had close contacts with multinational companies for the supply of imported agro-industrial inputs (particularly fertilizers; Roy, 1990). In India, when Green Revolution ideas first became influential, it was the government that decided not to import fertilizers from foreign corporations, but to establish new fertilizer plants within the nation (although these fertilizer industries were established with the collaboration of multinational corporations and international aid agencies). Hence, the expansion of international capitalism into the agricultural economies of poorer nations has not only seen multinational manufacturers being engaged in agricultural activities, but has also been influenced by international banks, international lending organisations and national development agencies (Feder, 1976). The tremendous support amongst international agencies for stimulating agricultural growth in the Third World is still evident in World Bank (1991) declarations of encouragement for international development agencies to introduce agricultural biotechnology in the Third World (call the next Green Revolution). Although multinational corporations dominate the provision of inputs like fertilizers, pesticides, and farm machinery, as well as being major players in the processing and marketing of agricultural produce, it can be seen that major agricultural changes were also significantly influenced by national government policies within the Third World, albeit with the help of international aid agencies and the World Bank (Gough, 1977; Griffin, 1979; Goody, 1980; Pearse, 1980; Bhalla, 1990). Indeed, at a national level, government pricing policies, and the provision of subsidised agricultural inputs and related production incentives, are reported to have had substantial effects on the take-up of Green Revolution innovations in each of Kenya and Tanzania (Christensen et al, 1987), India (Roy, 1990), and various Latin American nations (Valdes, 1987).

Even so, at a global level, there is considerable evidence that manufacturing is often conceptualised as the prime mover in agricultural growth in 'peripheral' economies. Yet at national and local levels various analysts have claimed that growth linkages between agriculture and manufacturing work in the opposite direction; with agrarian improvements, particularly as a result of the Green Revolution, enhancing manufacturing expansion in the Third World. Hence, the following section investigates the extent of Green Revolution participation in promoting manufacturing in the Third World, with the focus of analysis being on agriculture-manufacturing linkages at the national rather than the international level.

Green Revolution Diffusion and Manufacturing

Issues surrounding the diffusion of Green Revolution technologies are ardently debated in the development literature, with some researchers acknowledging the key role the Green Revolution has played in speeding up the pace of agricultural growth, particularly through the expansion of grain output in the Third World (the list here is huge, but it includes Brown 1970; Nutly, 1972; Hanumatha, 1974; Randhawa, 1974; Stavis, 1974; Johal, 1975; Havens and Flinn, 1975; Mandal and Ghosh, 1976; Day and Singh, 1977; Nyilas, 1977; Bhalla and Chadha, 1983; Pollard, 1983; Leaf, 1984; Dantwala, 1985; Chadha, 1986; Westley, 1986; Bhatia, 1988; Hossain, 1988; Malik, 1988; Lipton and Longhurst, 1989; Sharma and Dak, 1989; Byerlee, 1990; Hayami, 1990; Hazzel and Ramasamy, 1991; Mosse, 1991; McGuirk and Mundlak, 1992). Others criticise the Green Revolution for intensifying social inequalities and for its negative ecological effects (Frankel 1971; Tuckman, 1976; Griffin and Khan, 1978; Junankar, 1978; Gibbon et al, 1980; Pearse, 1980; Arnon, 1981; Baker, 1984; Shiva, 1991; Ninan and Chandrashekar, 1992). Detailed discussion of these effects is beyond the scope of this study. Here, the main issue of concern is the impact that improvements in farm production have had on manufacturing expansion.

What is notable in this regard is the lack of empirical investigations that examine links between farm production increases and growth in manufacturing output. Despite this, commentators on the Green Revolution have made various assertions, or in some cases assumptions, about the interaction of agricultural development and manufacturing growth. Griffin (1979, p238), for instance, made the observation that these new methods of cultivation require material inputs that must be obtained from agricultural supply industries, so that the '...expansion of industry is obvious'. Likewise, in his study of China's Green Revolution, Stavis (1974) noted that food production had increased dramatically and that there was continued expansion in the nation's chemical fertilizer industry (but without exploring the markets for this fertilizer production). Mittal and Chamola (1989) offer another example, when they credit the Green Revolution with a threefold increase in food production in Haryana (India), and link this to a companion 10% employment growth in agro-based manufacturing and a 3.2% growth in tractor and agricultural implements manufacturing. Yet these analysts assume that the temporal coincidence of these changes is casual, without exploring the character of local linkages between agriculture and manufacturing.

Many similar examples could be given, such as Arnon's (1981) comments on small scale agricultural machinery manufacturing in Pakistan's Punjab, Nabi's (1988) views on farm machinery production in the same nation, and Nyilas's (1977) comments on the general impacts of the Green Revolution in India. Examinations of the so-called heartland of the Green Revolution, the Indian Punjab, have been equally prone to assume agricultural growth is strongly tied to manufacturing expansion. Thus, Frankel (1971) predicted that the mechanisation of farm operations in the Punjab would push up the production of machines, implements and farm inputs, which would create more jobs in manufacturing, and Bhalla (1990) asserted that the rapid growth of the agricultural sector has had a widespread impact on the entire economy, and particularly on the manufacturing sector.

Without empirical evaluation of agriculture-manufacturing linkages at a national level, numerous researchers seem to accept that agricultural improvement has enhanced manufacturing expansion in the Third World. However, this view contrasts with most theoretical positions, which confer on manufacturing the role of the dynamic growth sector, with development being treated as a process of transferring resources from agriculture to manufacturing. This notion is well presented in dualistic development models.

Dualistic Development Models

In theoretical models of less developed economies, the 'sectoral growth' relationship has received considerable attention from researchers (Ghatak and Ingersent, 1984). In examining such 'sectoral growth' linkages, the role of agriculture and manufacturing has attracted considerable attention in the development literature. As Kuznets (1961) wrote, agriculture provides both food and raw materials for the rest of the economy. As a consequence, a growing agricultural sector provides an enlarged market for the goods and services of other sectors as it expands aggregate demand, as well as providing labour for employment in manufacturing through productivity gains in farming, plus an increase in capital that is available for investment in other sectors of the economy due to growth in farm profits. Hence, the fundamental base of the dual economy model is the shift of agricultural resources towards manufacturing sectors. Effectively, agriculture is treated as a contributory element in economic growth, but manufacturing is regarded as the dynamic element in the economy.

The basic framework for this dual economy model was elaborated by Arthur Lewis (1958). The main assumptions of his model are that the economy can be divided into two main elements: (a) an advanced/modern element with organised manufacturing activities; and (b) a backward/traditional element, which is mainly comprised of unorganised agricultural and other activities, that are primarily found in rural areas. He investigated the expansion of the capitalist, industrialised sector, which was seen to be encouraged by supplies of cheap labour from subsistence agriculture. He assumed that, without any loss of agricultural output in less developed countries, an unlimited supply of low-waged labour would be available for manufacturing expansion. The speed of economic growth that occurred was thereby determined by the rate of industrial-investment and by the pace of capital accumulation in the modern sector. Lewis described this phase of economic development as resulting in the commercialisation of agriculture, for these changes brought market discipline to the traditional agricultural sector which previously was seen to use land and labour alone in its production processes.

The fundamental drawback of Lewis's model is the assumption that the agricultural sector is a traditional sector with lower labour costs, from which surplus labour can be extracted readily for manufacturing expansion. This neglects the possibility that agriculture could be a leading sector in the promotion of economic growth for all sectors of an economy, through modern technological improvements. What is more, Lewis primarily considered 'cheap labour' as the major outflow from agriculture, when a modernised agriculture will create surplus agricultural produce that could be taken up by agro-processors and so constitutes another major outflow from this economic sector (as well as generating savings that could be used for investment elsewhere). Lewis thereby did not pay much attention to the potential role of agriculture in promoting manufacturing growth. As Fei and Ranis (1964) identified, this is a critical weakness in the Lewis formulation, for agricultural production can have a significant impact on manufacturing expansion. They argued that during the early stages of economic growth, the marginal productivity of labour is always near or equal to zero in subsistence agriculture (in other words, the increase in total output resulting from the use of additional labour is always close to zero or equal to zero). But for Fei and Ranis, if economic growth is to occur smoothly, then the transfer of surplus labour from agriculture to manufacturing should be preceded by rises in agricultural productivity, with the speed of surplus labour movement depending upon the rate of agricultural growth. Adding further to this line of argument are the obvious effects of increased agricultural production on other aspects of 'capital accumulation' (like credit policies, terms of trade, prices, etc.), which can help fuel expansion in manufacturing activity.

Some recoginition of these points is evident in Jorgenson's (1967) modification to the dualistic development model. Jorgenson emphasised that sustained agricultural growth was needed as agricultural surpluses were important for manufacturing improvement. His dual economy model assumed that surplus labour exists in the agricultural sector, but not in a situation of zero marginal productivity, so that the transfer of labour from agriculture into other sectors results in a decline in agricultural production. He focused on the technologically advanced stage of agriculture, where, for the expansion of the manufacturing sector in developing countries, it is essential not only to generate an agricultural surplus but also to maintain it through technical progress. He argued that this released resources which could become the pivot for manufacturing expansion; so technological change in agriculture increases the release of labour for employment in manufacturing. For Jorgenson, manufacturing output and the labour force in manufacturing ultimately come to dominate a developed economy as a consequence of a shift in consumer demand from agricultural to manufactured products.

In general terms, however, dualistic development models assume that the manufacturing sector is the prime mover in economic development, with essential resources for progress in this sector being extracted from the less efficient agricultural sector, for the benefit of the economy as a whole. A major drawback of dualistic theories is their neglect of service sectors, like tourism, transport and communication, banking and finance (Dixit, 1973). Dual economy models also postulate a closed-economy and tend to ignore the role played by trade in economic development (Ghatak and Ingersent, 1984). Even allowing for these lapses, question marks must placed alongside the assumption that agricultural improvement inevitably results in the freeing of labour, which can be shifted readily into the manufacturing sector. If farm improvements lead to the intensification of agricultural production, it is feasible that the labour requirements of farming will be higher, not lower. Also to be noted is the manner in which dualistic models assume that the outflow of agricultural resources into other sectors of the economy are 'obvious'. In addition, the interaction of agricultural and manufacturing activities are effectively seen to be decided by market forces alone. As such, dual economy models down play the role of government in the allocation of sectoral resources, even though market organisation and control over economic production by the state can have a major part to play in Third World economies (Gelb et al, 1988). In fact, the centrality of state actions is a key element of the Urban Bias Hypothesis, which holds that, far from being the result of a 'natural' play of market forces, existing patterns of Third World employment and migration are contrived products of biased governmental policies.

The Urban Bias Hypothesis

In his Urban Bias Hypothesis, Lipton (1977, 1982) claims that mainstream beliefs about the role of agricultural development processes in the Third World are overly simplistic. He explains that biases in development policies are the cause of persistent poverty in developing countries (such as reinvesting agricultural profit into urban-based manufacturing). He goes further in arguing that '...the most important class conflict in the poor countries of the world today is not between labour and capital. Nor is it between foreign and national interests. It is between the rural classes and the urban classes' (Lipton, 1977, p13). More significantly, Lipton advocates that there is an urban bias in development policies because urban elites dominate government organisations, political parties, business organisations, education systems and other attitude moulding institutions. As a consequence, the power of 'urban people' is such that they are able to direct a disproportionate share of national resources towards policies and activities that most favour urbanisation and urban residents, to the detriment of the rural population. Lipton not only asserts that urban manufacturing has been developed at the cost of rural agriculture, but also that better-off, larger-scale farmers owe much of their wealth to the urban-biased nature of development policies. Effectively, the town gets cheap food, while the better-off farmers are said to receive price supports and subsidies, which are out of the reach of small-scale producers. For Lipton (1982), this notion of Urban Bias has relevance in the Indian Punjab. He argued that in early 1970s, when labour shortages emerged in the Punjab state (due to a massive workload on the farms) at a time when gains from the introduction of high yielding crop varieties were very evident, that larger-scale farmers successfully pressed the 'urban state' for subsidies so that labour could be replaced by equipment (with rural development also being affected by larger-scale farmers spending their extra 'Green Revolution incomes' mainly on urban products, so increasing sales and incomes in urban areas). Even given such biases, Lipton argued that agriculture provides the basic resources for manufacturing growth in the Third World.

Lipton's views have been supported by other development writers, who have noted that agricultural profits are weakly reinvested in the agricultural sector, due to a combination of biases in government investment, the process of private trading in rural areas and low farm commodity prices. Thus, Todaro and Stilkind (1981) noted how millions of people in Africa, Asia and Latin America have migrated from the countryside to urban centres often as a result of government policies. They found that in the 1960s and 1970s, government policies in most Third World countries favoured manufacturing growth, while providing insignificant investment for agricultural improvement, with the result that per capita food output in many nations decreased at the same time as rapid urbanisation was occurring. The same pattern was identified by Wong (1976), when discussing development patterns under China's first five-year plan. Here, the agricultural sector was starved of development funds, so that it received just 9.9% of plan investment, compared with the 64.5% that went into manufacturing.

At the same time, processes of private trading for agricultural commodities are dominant factors in rural economies in the Third World, yet it is urban-based traders and wholesalers that most commonly appear to control marketing systems. As a result, much of the money that is derived from marketing agricultural products is drawn into cities, instead of being reinvested in rural areas. This problem has been exemplified in a study by Harris and Harris (1981, 1984, 1989), who investigated the role of agricultural traders in rural development in the North Arcot district of Tamil Nadu in south India (these traders handled paddy and shelled rice, as well as agricultural inputs such as fertilizers, and investment goods like pumpsets). From a sample survey of rice cultivators and landless labourers, together with one of agricultural traders which was undertaken at two points in time (1973 and 1982/83), they concluded that a net transfer of resources was occurring from the country to the town. This was achieved because activities like wholesaling and the sale of manufactured goods were controlled from the towns, with higher levels of added value accruing to urban entrepreneurs.

A further example of a lack of return of agricultural profits to farming has been given by Lele (1985). In his investigation of Nigeria, he noted that the agricultural share of the GNP is higher than that of the non-agricultural sector, yet funds drawn from agricultural taxes have not been reinvested in a manner that will assist the future development of agricultural production. Largely, these funds have been used to support consumption by the urban population. Likewise, Gleave (1992) found that in Nigeria, Senegal and Ghana, resources drawn from the agricultural sector have provided much of the fiscal base for the national government, but this sector receives relatively little investment in return.

In reality, of course, the manner in which agriculture gains or loses from governmental decisions is decided across a broad spectrum of policy areas. As Berthelemy and Morrison (1989) note, in Ghana, Madagascar, Mozambique and Tanzania, government policies do not directly extract agricultural surplus for the sake of urban consumers, but their policies still retard growth in the agricultural sector. This arises because these governments have been unable to stimulate the production of either manufactured agricultural inputs or manufactured consumer goods, and as these are not available for the farm population, the prices of cash crops are of little importance in stimulating sectoral improvements, given that farmers find little to buy with the money they make. In other contexts, the pattern of agrarian development has been distorted in order to favour broader governmental goals. For Janvry and Subbarao (1986), this occurs in much of Latin America, with Radwan (1974) pointing to the same scenario in Egypt. Here government support is found for agriculture, but largely for a limited range of farm products. In particular, it is the larger-scale farmers and those who produce for the export market who benefit from government support; with these sectors being favoured partly for political purposes and partly because governments have built up a huge foreign debt owing to their strategy of forced industrialisation. Not only does much of the benefit from such export oriented policies reach only a small minority of rural residents, but these (usually wealthy) residents also tend to consume relatively little that is produced in their local area; so the primary benefit from this income gain flows up the urban hierarchy and even to locations outside the country.

Agricultural pricing is also an element in the Urban Bias Hypothesis, for it is charged that pricing policy is little more than a method for keeping down the price of agricultural goods for the benefit of urban consumers (Knudsen and Nash, 1990; Sengupta, 1991). As Ahmed and Mellor (1988, p2) put it: '... food pricing is likely to be used to benefit the urban constituency at the expense of farmers'. In this regard, the agricultural sector is often seeing its income kept down deliberately. In many Asian countries, where governments derive a substantial proportion of their revenue from export agriculture, this is said to occur because state marketing boards purchase farm outputs at a domestic price that is set low and then export these goods at (higher) world prices (Breveman and Kanbur, 1987).

At the heart of the Urban Bias Hypothesis is the notion that agriculture could play a more pivotal role in economic growth, yet its potential is neglected for the sake of promoting the urban manufacturing sector. For economies that are dominated by agriculture, this notion can be criticised on the grounds that, for economic development, agricultural surpluses need to be extracted in order to provide funds for investment in other sectors of an economy (manufacturing, infrastructure, services, etc.). Yet the precise distributional pattern of surplus resources across economic activities will depend in part upon the policies of national or regional governments. Depending on these policies, the sector that gains most benefit from resource redistribution could be agriculture or manufacturing; depending upon the specific policies of individual governments. Of course, these policies may vary across Third World nations or even between regions within nations. Even so, in the context of the main argument of this thesis, we are not particularly concerned with the extent to which the accuracy of Lipton's hypothesis varies across Third World nations. What we are interested in is the extent to which Lipton's Urban Bias Hypothesis is relevant to the Indian Punjab.

In reality, there is still need for detailed empirical research at a micro-level on growth linkages between agriculture and manufacturing to help assess this (e.g. Gleave, 1992). There are a variety of methodological approaches that can be used for such a purpose; all of which offer limited and particular insights on linkage patterns. In the discussion that follows the merits of various methodological approaches will be assessed in order to provide the context and a justification for the empirical analysis that has been undertaken in this thesis.

Methodological Approaches

Development writers have attempted to transpose theoretical ideas into empirical evaluations of the role of agriculture in development processes for a long time. Yet it is no surprise that the results they have obtained differ, owing both to contrasting economic climates during their study periods and across nations, as well as due to the different methodological approaches they have adopted. It is the second of these features that concerns us in this section, for, no matter what the methodology that is used, any single approach to analysing agriculture-manufacturing linkages is partial. As such, it is essential to be aware of the particular insights, and the specific limitations, of any single analytical mode. Drawing on applications throughout the Third World (and in some instances from advanced economies), this section evaluates the strengths and weaknesses of four primary methodological approaches: (a) input-output analysis; (b) analyses of sectoral covariations; (c) inter-sectoral resource flow analysis; and, (d) questionnaire survey analyses of linkages between farms and manufacturing plants.

Input-Output Analysis

Input-output analysis is designed to offer a national or regional accounting of the interaction and integration of economic sectors. This technique provides a quantitative description and analysis of the structural features of an economy, including identification of interdependence amongst producing sectors (such as the backward and forward linkages of agriculture, manufacturing and mining), as well as the destinations of final consumption (like household purchases of food and furniture). An input-output table, which provides the basic data source for any analysis, uses a double entry system for economic transactions; so market exchanges between, say, the insurance sector and the paper industry are recorded both as sales from one to the other and as purchases by one from the other. Using total price payments as the measure of linkage, an input-output table provides a 'complete' picture of the structure of economic transactions in an economy (in so far as data allow). In essence, it gives a systematic description of interdependence between different sectors of the economy. As such, input-output tables are held to be highly desirable tools for economic planning and, in some centrally planned economies, such tables have even been used for fixing the prices of different commodities (Saluja, 1980).

Nevertheless, few studies have used input-output analysis specifically to explore agriculture-manufacturing linkages. One study that has done this is Falcon's (1967) exploration of the links between these two sectors in West Pakistan, in which he used input-output tables for 1962-63 (adapted from data provided by the National Planning Commission of Pakistan). Empirically, Falcon concluded that agriculture has a high internal requirement for its inputs (viz. it was a relatively self-contained sector compared with other parts of the economy), with the direct and indirect contribution of manufactured inputs into agriculture standing at just 40%. Also of note was the fact that flows of crops to small-scale factories were greater than to large-scale agricultural processors. Nevertheless, agricultural development was believed to have an important influence on manufacturing growth, given that sales of locally manufactured products like fertilizer, tube-wells, diesel engines and pumps, were directed significantly toward the farm sector. However, as Falcon's (1967) analysis was for a time period prior to the Green Revolution, when farmer-manufacturer linkages can be expected to be less than they became later, his conclusions are only instructive for our purposes. Providing some prospect that a significant Green Revolution effect would be found is Saluja's (1980) analysis of India in 1970/71. But Saluja does not find particularly convincing evidence of strong agriculture-manufacturing links. Putting the interaction of these sectors into figures, he found that 24% of total agricultural output went to manufacturing, whereas only 15% of manufactured production went into agriculture. In the case of the Bangladesh economy, an input-output analysis for the year 1976/77 showed even weaker agricultural output linkages, for the bulk of agricultural products went directly to consumers rather than to the manufacturing sector (Alauddin, 1986).

All these results seem to provide a powerful message about the pattern of linkages within an economy. Yet they also raise characteristic questions for any input-output analysis, in that they provide no real answers as to why these patterns exist. Even if a shift occurs over time toward more manufactured goods being taken into agriculture, we cannot tell from an input-output analysis whether this results from the initiative of farmers, is due to government incentives or arises from manufacturers' pressure. Input-output tables tell us about the structure of an economy, but they do not indicate what is driving change within that economy.

Furthermore, input-output tables cannot be precisely applied to open economies (e.g. a regional economy within a nation). Most obviously this is because of the sparsity of available data and due to reporting errors in inter-regional commodity flow figures; given that various modes of transport are used for this purpose, and strict border checks on commodity inflows and outflows within nations are rare (and for financial and service transactions they are even rarer). In addition, input-output tables inevitably use rather gross sectoral classifications of economies (otherwise their data demands would be even more problematical), so that they do not provide detailed information on agriculture-manufacturing linkages at a micro-level. Instead, insight tends to come from the broad perspective of linkages at the national or regional level (but not from the local geographical level). Yet, even if an input-output table is constructed for a nation, it basically describes existing or static inter-sectoral relationships, which are reported in terms of current prices or physical flows alone.

Moreover, due to the complexity and quantity of data that are required to construct input-output tables, as well as the extensive adjustments that are required to synchronise information from varied sources, these tables are often long delayed in being produced and sometimes have to use information from different time periods to estimate trends (e.g. Ghuman, 1985, updated the input-output table of 1969/70 in the Indian Punjab in 1977/78, but had to use data on different time periods taken from official reports in doing so). Moreover, even if comparisons are made of changing patterns over time, input-output analysis is still incapable of distinguishing cause from effect. As a consequence, input-output tables do not permit a particularly satisfactory estimation of the overall impact of agricultural growth on manufacturing expansion (or vice versa); especially given that there is often a lack of temporal co-existence in data on the agricultural and manufacturing sectors of an economy. Once we move below the national level, the problems of data incompleteness further limit our insight on agriculture and manufacturing linkages. It follows that while evidence from a input-output table, or preferably from two taken at different time points, offer important information on agriculture-manufacturing linkages, on their own it (or they) tells us little about causality.

Analysis of Sectoral Covariation

More often providing a direct vision of temporal change, adjustments in the structure or performance of the agricultural and manufacturing sectors have been assessed to identify sectoral covariations. For this approach, the share of the net domestic product or the rate of production growth in the agricultural and non-agricultural sectors are compared in order to assess the degree of covariation in their patterns of change over time. Effectively, this method tells us about the relative rate of growth of the agricultural and non-agricultural sectors, whether at the national or at the regional level. It also shows the relative pace of economic growth in the agricultural sector of a nation (by investigating the percentage share of net state domestic product that is contributed by agriculture and (say) manufacturing). Studies of this kind have been undertaken by Rehnberg and Stahl (1962) for Puerto Rico (1940-1961), Leipziger and Peter (1989) for South Korea (1970-1985), and Nachane et al (1989) for India (1971-1981). These studies have concluded that the agricultural sector is a prime sector driving growth in India and Puerto Rico. In South Korea, a stronger performance was recorded for the manufacturing sector, which was said to have been the main cause of accelerated agricultural growth.

But these analyses of sectoral covariations effectively focus simply on shifts in the share of total production that sectors have within an economy (viz. on the end-products of growth processes). They do not evaluate either direct or indirect linkages between agriculture and manufacturing (i.e. growth processes themselves). Even if they calculate covariations in temporal growth rates, this does not provide information about the support structures that exist for the agricultural and manufacturing sectors of an economy. Put simply, these two sectors could be growing at an equal pace, so providing the appearance that growth in one is dependent or promotes growth in the other. In effect, while covariation in production change is suggestive of growth linkages, in reality it does not answer the question of whether the identified covariation has occurred by chance or is due to a direct causal association. As a consequence, covariation analyses can only provide rough indications of linkages between these (or other) sectors. For more informed insights on the impact of agricultural growth on manufacturing expansion (or vice versa), analyses need to focus more explicitly on actual resource flows between sectors.

Inter-sectoral Resource Flow Analysis

By its title and its stated intentions inter-sectoral resource flow analysis would appear to offer direct insights on agriculture-manufacturing growth linkages. In intent, inter-sectoral resource flow analysis investigates the terms of trade between economic sectors, which are evaluated with regard to the ratio of outflows of (say) agricultural commodities into non-agricultural sectors and the inflow of non-agricultural items into agriculture. The analysis of inter-sectoral resource flows (or terms of trade) has been a significant concern for development writers, who have sought to assess whether substantial investment and technological progress in agriculture has resulted in capital accumulation within that sector or produces a shift in economic gains from the agricultural to non-agricultural sectors. In reality, however, rather than examining actual flows of goods and services between sectors (much as input-output investigations attempt), inter-sectoral resource flow analyses are mainly based on a comparison of the index of prices paid for farm produce and the index of prices for those manufactured goods that are purchased by farmers.

Notable studies of this kind have been done by Ohkawa (1970) for Japan (between the years 1875 and 1965), and by Ishikawa (1967) and Lardy (1983) for China over the year 1949-1959 and 1952-1981, respectively. These studies concluded that peasants have benefited from a significant improvement in the selling price of their agricultural produce, relative to the price of those manufactured goods that they use as farm inputs. However, contrary results have been reported by Sharpley (1979) for Kenya over the period 1964-1972, as well as by Cavallo and Mundlak (1982) for Argentina during the period 1940-1972. For Sharpley the net capital outflow of goods from the agricultural sector to the non-agricultural sector increased at a fast rate, but the inflow of intermediate inputs (like fertilizers, chemicals and seeds) and investment goods (including farm equipment) from non-agricultural sectors into farming were found to be extremely small (in fact, capital flows out of the agricultural sector into the non-agricultural sector were ten times greater than flows into the agricultural sector, yet as per capita income in the agricultural sector was greater than in the non-agricultural sector, Sharpley held that a net capital outflow was being extracted from the agricultural sector). Likewise, Cavallo and Mundlak found that the profitability of agriculture in Argentina was low because the prices received by farmers were poor compared with the prices paid by farmers for manufactured goods.

All these studies have been undertaken using similar methods, and the style of analysis has been the same in all of them (viz. comparing the prices of inputs and outputs across economic sectors). As this method is concerned (mainly) with the price of agricultural and manufactured products, it provides little insight on causal links between the spatial distribution of agricultural crops and any related growth consequences for agro-based manufacturing. This is because the terms of trade method does not evaluate spontaneous manufacturing expansion to see if this results from agricultural improvement in a nation or a region. Effectively, it simply sees whether agriculture is relatively advantaged or disadvantaged through the pricing mechanism in its economic transactions with other sectors. Despite offering insight on economic effects in this way, inter-sectoral resource flow analysis does not directly assess the causes of terms of trade nor how this feeds into growth promotion across economic sectors. For explicit attention to this latter process, researchers have commonly had to rely on questionnaire surveys of farms or manufacturing plants.

Questionnaire Surveys of Agriculture-Manufacturing Linkages

Due to existing limitations for each of input-output analysis, investigations of sectoral covariation, and examinations of inter-sectoral resource flows, questionnaire surveys have been used for the direct evaluation of linkages between different economic sectors at both macro- and micro-levels. The prime advantage of this method is that it not only allows researchers to inquire about direct growth linkages between agriculture and manufacturing, but also provides an indication of which sector takes the lead in any growth processes (e.g. by asking whether demand from the manufacturing sector 'forced' farmers to grow more or whether it was increased agricultural production that encouraged spontaneous growth in manufacturing, either in order to meet the growing demand for farm inputs or to respond to the availability of abundant supplies to process more farm produce). In reality, questionnaire surveys are one of the most effective methods for directly assessing the geographical distribution of growth linkages between agriculture and agro-based manufacturing. Yet my review of the literature revealed only one empirical study set in a Third World nation which both based its methodological approach on a questionnaire survey and was specifically designed to assess connections between output growth in agriculture and manufacturing. While it is true that unpublished research reports associated with micro-level projects might be available in huge numbers, it seems that there is a paucity of readily available work on agriculture-manufacturing linkages that uses a questionnaire survey approach (albeit questionnaire surveys are an essential element of some of analytical methods described earlier, such as data collection for input-output analyses). Certainly, even unpublished studies are not available in the Punjab, even for the examination of single aspects of farm-related manufacturing; although Bhalla and Kundu (1983), Singh (1986), and Sahota (1989) have all used questionnaire surveys to investigate agricultural machinery plants in small towns of the state. Surprisingly, however, these studies did not concentrate upon the growth effects of the Green Revolution on the manufacturing sector (in fact, in their questionnaire surveys their comments on the links between the Green Revolution and manufacturing growth were restricted to the observation that the number of manufacturing plants in the state had increased since the mid-1960s).

The one instance of a Third World study that I found which is based on a questionnaire survey and does focus directly on agricultural-manufacturing linkages is that by Child and Kanada (1975) on the Pakistan Punjab. They interviewed 173 agricultural machinery manufacturing firms, with a view to examining the effects of the Green Revolution on the expansion of these small-scale industries. Significantly, they found that rapid spontaneous growth (without subsidies, tax concessions, and special credit arrangements) occurred in the small-scale manufacturing sector as a result of agricultural growth. This conclusion was reached because manufacturers reported that increases in agricultural output had generated demand for more output in the domestic manufacturing sector. However, for our purpose, what is significant about this study is that it only examined the early effects of the Green Revolution; albeit even for this time period there is a scarcity of empirical work on the direct impact of agrarian growth on manufacturing expansion in the development literature. Hence, the sustainability of agriculture-manufacturing growth effects in Third World nations still needs to be identified by development researchers.

Methodologically, questionnaire surveys are valuable research tools for identifying the coexistence of agricultural growth and manufacturing expansion, and whether manufacturers see growth in local farm production as a primary reason for increasing their output. But what should be noted is that questionnaire surveys are unlikely to provide a complete picture of growth linkages, so they will generally need to be supplemented by other methodological approaches. Principally, this arises because limitations of time and finance mean that (academic) researchers are generally able to collect data from a limited number of farm or manufacturing outlets. As such, the results gained from questionnaire surveys need to be placed in the context of analytical methods that provide a broader insight on change in the agricultural and manufacturing sectors.

Significantly, no study of this kind has been undertaken in the Indian Punjab. Yet contradictory views exist within the literature on the Punjab economy on whether agriculture and manufacturing are tightly connected or have few direct growth linkages. The nature of these disagreements are explained in the next section, with a view to highlighting the character of this debate, as well as providing an indication of the need for the empirical evaluation of agriculture-manufacturing linkages that has been undertaken in this thesis.

Views on Agricultural-Manufacturing Linkages in the Punjab

Suggestions of Strong Linkages

With the onset of the Green Revolution in the mid-1960s, there was a transition in Punjabi agriculture from long-established production methods to the adoption of modern technology. The introduction of high yielding crop varieties required heavy use of chemical fertilizers, insecticides, pesticides, weedicides and machinery (tractors, electric motors, etc). Gill (1988) observed that these inputs to the farm sector were purchased from local markets, which heightened the integration of agriculture into the market economy. This seems to indicate that agriculture had much to do with promoting manufacturing growth. But Gill also believed that increased farm income had indirect economic effects, as farmers invested their new surplus wealth outside agriculture; particularly in transport, cinemas and coldstorage facilities. Although he did not undertake any empirical analysis of these effects, Gill argued that demand from farmers was responsible for promoting manufacturing growth within the state. This claim was made without providing evidence that farmers purchase their production inputs from local suppliers or markets. Moreover, Gill effectively assumed that the major part of farm production was sold locally. But all he provided in support of this was the evidence that the ratio of per capita manufacturing output in the Punjab compared with whole of India increased from 101.0 in 1970/71 to 147.89 in 1985/86, without determining that this was due to agricultural processing or input supply.

This generally positive view of the impact of agriculture on manufacturing growth can also be found in a notable work on the Punjab economy by Bhalla (1975). This input-output study for 1969/70 revealed that some agricultural products had low backward and forward linkages within the state (like wheat, rice, maize, cotton, sugar-cane, pulses including gram,'bajra' and the allied activities of animal husbandry, as did some manufacturing sub-sectors like textiles, metal products, printing and publishing, all but electrical machinery, and transport equipment). However, high backward linkages were recorded for final manufacturing output for dairy products, grain mill products, edible oils and other food industries. Extending this work to 1979/80, Bhalla et al (1990) concluded that because of close input, output, and consumption linkages, rapid agricultural growth was accompanied by even faster growth in the secondary (industrial) and tertiary (services) sectors. They further argued that when forward and backward linkages are examined for 1969/70, only the agriculture and agro-processing sectors generated high forward and backward linkages. Yet by 1979/80 many machine-based and metal based industries, as well as trade, transport, banking, real estate, and other services, were found to be generating high forward and backward linkages, despite large import leakages.

Taking this argument further, Bhalla (1990) examined agricultural growth and manufacturing development in the Punjab between 1970/71 and 1987/88 and concluded that all sectors of the Punjab economy were recording impressive economic growth rates. Using secondary data on agricultural production, along with information on the use of agricultural inputs, data on production and employment in manufacturing units, he concluded that manufacturing relied on local resources, with the workers employed in these manufacturing plants circulating between seasonal agricultural work and casual industrial work. Bhalla recognised that the Punjab's manufacturing industries began to expand their production capacity before the advent of Green Revolution, but argued that by the mid-1960s it was agricultural growth that was creating a market for existing manufacturing units, with rising demand for agricultural machinery and agro-processing following in the wake of the Green Revolution (and depending on local resources). As well as rising farm incomes increasing demand for locally-produced consumer goods, Bhalla envisaged that agriculture in the Punjab was getting more tightly linked to local non-agricultural sectors for the supply of its inputs. This, he believed, had created expansion possibilities for manufacturing. Yet all these conclusions were reached without investigating direct links between agriculture and manufacturing. Indeed, while Bhalla accepted that manufacturing expansion was slow (despite the rapid growth of agriculture), he held that this was due to a large outflow of funds from the state and a lack of sufficient investment in domestic industry; not from weak local links between agriculture and manufacturing.

Providing a different empirical base for a similar view, Chadha (1986) held that although the Punjab economy was dominated by primary sector activities between 1950 and 1985, due to forward and backward linkages, most secondary and tertiary activities had their roots in the primary sector. This view was supported by noting that the number of urban centres increased from 106 in 1971 to 134 in 1981, with the assumption being made that urban growth resulted largely from Punjab towns serving as centres for agricultural marketing and trade, as well as for agro-processing. Again, Chadha did not examine whether expansion in towns was influenced by surrounding agricultural areas or whether farmers purchased their inputs and sold their outputs within these towns. Indeed, while he argued that the output of small units which manufacture agricultural tools and implements registered fast growth in response to mounting demand from rapid output expansion in agriculture, he also recorded that the market for those agro-industrial products and for consumer goods which are manufactured in the Punjab had expanded beyond the state's territory. As he did not study whether expansion in these manufacturing sectors occurred because of linkages with the state's agricultural economy, the question of whether the real impetus for this manufacturing growth came from outside the state was not answered. All that could realistically be said is that the Punjab's development strategy emphasises that the expansion of agriculture should be accompanied by a network of small-scale industries, based either on agricultural raw materials or the manufacture of agricultural implements and consumer goods.

Possibly indicating that the links between agrarian expansion and manufacturing growth are causal is that fact that highest levels of production in both agriculture and manufacturing occur in the same places in the state. Thus, the central belt of Punjab, which is agriculturally the most developed, is the area which is most advanced in manufacturing. Most specifically, the southwest of the Punjab is an area that is dominated by cotton textile manufacturing, as well as the major zone of farm cotton cultivation. These points are clearly made by Gosal and Krishan (1984) in their investigation of regional disparities in levels of socio-economic development in the Punjab. Once again their results point to potential causal linkages but the existence of such links were not investigated empirically, but asserted. However, even if the developed agricultural areas are also the prime manufacturing zones, it is critical to question whether manufacturing production has expanded due to demand from the state's farmers or whether manufacturers sell much of their output outside the state. Additionally, it is pertinent to ask if agriculture developed due to increased demand for agricultural raw materials within the state (rather that to meet manufacturing demands).

The same point can be levelled against the conclusions of the informative research of Chaudhri and Dasgupta (1985). They also noted that strong associations exist between agriculture and manufacturing, when they observed that within the Punjab those industries which constitute the bulk of the state's manufacturing activity are food products, edible oils, textile products, cotton and wool textiles. These agro-based industries in fact accounted for half of all manufacturing production and slightly more than half of all manufacturing employment. Yet these researchers recognised that '...we have little or no information on the extent to which saving of agriculturists have financed capital formation elsewhere in the economy' (p161). Nevertheless, they justify their assumption that significant growth linkages exist between these sectors, by noting how value added increased in both agriculture and manufacturing from a common base of 100 in 1960/61 to figures of 162 for agriculture and 250 for manufacturing in 1974/75. They go on to point out that the value added per male worker increased from rupees 1,052 in 1960/61 to 1,443 in 1970/71 in agriculture and from rupees 1,148 to 2,112 in manufacturing. However, all this shows is that both sectors grew in parallel; it does not justify the conclusion that growth in one produced expansion in the other.

The same point can be made about the lack of empirical verification for the assertion of Mehta et al (1979, p128) that '...recent developments in the Punjab are sufficient to indicate a very high correlation and interaction between agricultural and manufacturing sectors of the state', as well as for Pollard's (1983) argument that agricultural development provided a direct stimulus to industrial sectors like engineering, fertilizers, metal products, transport equipment, and chemicals. All this might be true, but none of it is backed by appropriate empirical evidence. Moreover, while input-output studies do point to strong links between the agricultural and manufacturing sectors (e.g. Bhalla et al, 1990), they provide no insight on the direction of causation. Is agriculture stimulating growth in manufacturing or is a growing manufacturing economy making use of (under-utilised) local (farm) resources? On this issue the jury appears to be out, for, as the next section shows, there are many researchers who hold that agriculture-manufacturing linkages in the Punjab are not strong.

Suggestions of Weak Linkages

With a lack of firm empirical evidence on linkage patterns, researchers on both sides of the argument have found selective evidence to support their view on the strength of connections between agriculture and manufacturing. For those who believe that these linkages are weak, a common line of argument is that manufacturing growth in the state falls far behind the pace of change in agriculture. Thus, Singh (1987) held that spectacular increases in farm output between 1960 and 1976 were accompanied by relatively small increases in manufacturing production (without providing any evidence, he claimed that small-scale manufacturers are mainly producing for outside markets and depend heavily for their raw materials on other states). As with Alam (1987), who makes the point that growth in manufacturing has largely depended on raw material supplies from outside the state (along with demand for Punjab products coming from outside the state), Singh provides no empirical support to back his contentions on the geography of linkage flows. However, Alam does note that small-scale industries in the Punjab are without much product diversification (producing mainly woollen textiles, hosiery, cycles and cycle parts, small agricultural implements, steel re-rolling and sports goods). If this is the case, then both backward (supply side) linkages and forward (demand side) linkages for manufacturing could be weak within the state, as the supply of inputs for these sectors is not plentiful locally. Moreover, a contrast clearly exists between the reported absence of agro-processing companies and the abundance of inputs that the state could provide to these enterprises.

Sandhu and Singh (1983) provide another example of researchers doubting the strength of linkages between these two sectors. They conducted a study which mainly concentrated on the production and employment of small-scale manufacturing units between 1973/74 and 1979/80. Here, they argued that agricultural-manufacturing linkages were weak because manufacturing enterprises had failed to develop around certain raw materials that were in plentiful supply and which had seen significant agrarian growth (as exemplified by the processing of potatoes, and by confectionery and bakery products).

For Azad (1987) no strong linkage has emerged between agriculture and manufacturing, because the manufacturing sector of the state has not produced vital requirements for developing the agricultural sector. Illustrating this point he argues that it has failed to meet demand for tractors and chemical fertilizers from the farm sector (as most of the tractors used and fertilizers consumed in the Punjab come from outside the state). Kainth and Bawa (1985) add a further dimension to this argument by showing that the Punjab's agricultural sector exported much of its produce, but little of it in processed form. For example, of the 21.6 million metric tonnes of wheat that the Punjab exported to other states in 1976/77, wheat flour made up only 12,800 metric tonnes. By investigating the percentage share of agriculture and manufacturing in the state's net domestic product, they argued that there has been a substantial transfer of income from the agricultural to the manufacturing sector. Without knowing the actual pattern of spending of agricultural income, or destinations of sales of agricultural produce, they assumed that poor linkages exist between agriculture and manufacturing (so did Aulakh and Raikhy, 1980).

It appears then that there is sharp controversy over the nature and intensity of linkages between agriculture and manufacturing in the Indian Punjab. This controversy exists in a situation where all studies agree that both sectors have progressed economically. More than this, in the Indian Punjab the crucial question is not only whether improvements in agriculture and manufacturing are related to one another, but also whether advancement in manufacturing occurred to meet increased demand for inputs from the farm sector and an increase in the supply of potential inputs for agricultural processors. However, before investigating these queries for the Punjab, it is pertinent to analyse where the Punjab stands within the Indian economy (as state economies are greatly affected by the national economic environment and by national government policies). Hence, the next chapter contains an examination of economic growth in the Indian states, to see if those states which are prime recipients of agricultural output growth are also leading states for the expansion of agro-based manufacturing.

Chapter 3

Agriculture and Manufacturing in the Indian States

The primary objective of this chapter is to assess trends in agricultural growth and manufacturing expansion in India and identify the extent to which economic growth has been experienced across the Indian states. In examining these phenomena, temporal change in state production is analysed for both agriculture and agriculturally-based manufacturing. The objective is to see if those states which are at the forefront of agricultural growth are also prime agents for expansion in agro-based manufacturing. Although agriculture-manufacturing linkages at the national level are not wholly dependent on domestic demand or the local availability of raw materials (due to the open economies of states within India), state-level trends do give a broad approximation of agriculture-manufacturing linkages at the national scale. However, before evaluating these connections it is necessary to understand the context in which such linkages occur. To provide this, the chapter opens with a description of national development policies, so as to identify the relative balance of national development emphases, as well as to place policies toward the Punjab in their broader context. This will also help us understand that, in a planned economy like India's, government policies have had a critical role in determining the guide-lines for economic development in different states. Although it is not feasible to assess the actual impact of government policies on development, an examination of national agricultural and industrial policies, and a discussion of India's five-year plans, do provide indications of the direction of national influence on agricultural and manufacturing performances within the Indian states. This is followed by a more encompassing examination of economic development indicators, which places the Punjab in the context of the other major states of India (i.e. those states which had a population of ten million or more at the 1991 census; Figure 3.1). The purpose of this section is again contextual, for general economic performance differentially stimulates economic activities across sectors, while infrastructural improvements ease processes of sectoral improvement. Having examined the contexts for growth that exist across the Indian states, the final section asks whether states with higher growth rates for agricultural production score high in their rate of production improvement in agro-based manufacturing.

To achieve these objectives, an examination of statistical information is undertaken at both national and state levels. The national level analysis is presented since 1951, when India's planning era began. But the state level analysis is only from 1966 onwards, for this was the year when the state which is the present-day Punjab was created. The reason why this year (1966) is crucial within the framework of this thesis is that this date also coincides roughly with the arrival of the Green Revolution in India, which occurred in the mid-1960s.

National Development Policies

In India, legislative powers are divided between the centre and the states, with the latter being the political-administrative units of the Indian federation. As is common in federal states, the rate and direction of economic growth in the Indian states are influenced in key ways by fiscal and monetary policies at the national level (Nadkarni, 1989). In India, domestic economic activities have been subject to a wide array of detailed and discretionary national government control. So although individual states have considerable

Figure 3.1
The Indian States

Source: Census of India, 1991a

autonomy in decision-making, the centre exercises fundamental control over key areas of economic policy (Bhatia, 1988).

One clear illustration of this is given by the financial system. This is dominated by the national government, which controls banking through the Reserve Bank of India, which sets the bank rate, regulates credit and approves major loans to state governments. Indeed, the Indian monetary system is not only characterised by a key governing role for the Reserve Bank of India and its sister institutions (the National Bank of Agriculture and Rural Development, the Industrial Development Bank of India, the Industrial Finance Corporation of India, and the Industrial Credit and Investment Corporation of India), but also sees the strength of national government influence through the nationalisation of financial institutions; as occurred for many life insurance companies (1956), commercial banks (1969), and firms covering general insurance activity (1973), all of which now fall under national government control. As such, the influence of the national government over the financial system has become a pervasive factor (Nadkarni, 1989). For rural areas, the importance of this is clear, for with the nationalisation of the banking system in 1969, the commercial banks entered into agricultural finance under government encouragement, whereas prior to nationalisation they were little involved in this sector. Then, in 1980, a second phase of nationalisation occurred which led to the public sector controlling the overwhelming share of national banking activities (i.e. many those companies that were not nationalised in 1969 were now brought under public ownership). One result of this was direct intervention by the national government in the regulation of bank credit so funds for priority economic sectors and poverty alleviation were favoured (Thingalaya, 1989).

On a broad economic front, both the agricultural and the manufacturing sectors of India are directly affected by the plans, policies, and fiscal manoeuvring of the national government. It is important, therefore, to understand national agricultural and manufacturing policies, as these provide important clues as to the priorities that surround investment decisions, both sectorally and geographically. In addition, an understanding of national five-year plans is required, in order to appreciate how priorities in sectoral investment trends have shifted over time. Each of these is investigated in the sections that follow.

National Agricultural Policy

The rate and pattern of agricultural growth in each of India's states is affected significantly by plans and policies established by the central government (Westley, 1986). From the outset of India's independence, the national government revealed a concern for improvements in the agricultural sector. As early as 1947, significant steps were taken to improve agriculture by the national government. These included land reform measures intended to eliminate the exploitation of peasants and provide security for farm tenants. The two basic objectives of these measures were: (a) to abolish intermediaries (such as Zamindars and Jagirdars) between the government and tillers, so as to ensure security of tenure and eventually make tillers the owners of the land they farmed; and (b) to impose a size ceiling on the ownership of landholdings and distribute any surplus land among the landless poor. These steps provided a major incentive for investment in, and for the growth of, agricultural production in large parts of the country (Rao, 1991). At the same time, attention was given to encouraging easier farm credit and promoting the marketing of agricultural inputs and outputs by co-operatives. These were important steps, as the banking system appears not to have offered much support for agriculture until at least the late-1960s (Thingalya, 1989); so that farmers were left to rely unduly on local money-lenders. Today, major sources of credit are available to the agricultural sector from the National Bank for Agriculture and Rural Development (with help from the Reserve Bank of India), which provides finance facilities through cooperative institutions. Research assistance has also been offered through agricultural universities in every state, with the National Seed Corporation and the State Farms Corporation of India putting considerable efforts into producing better seeds for Indian conditions. In addition to this, community development programmes were established to promote rural welfare and a wider participation in development activities (Tyagi, 1994).

Under India's constitution, state governments were given some control over agricultural affairs, as in fields like land reform, agricultural credit, land revenue assessment, and the taxation of agricultural income. But the central government maintained a substantial degree of control over state-level programmes through its much stronger planning capacity and its greater expenditure commitments (Bhatia, 1988). Hence, the national government not only establishes overall economic policies and a wide range of prices (exchange rates, interest rates, prices of products such as steel, cement, fertilizer, etc.), but also controls inter-state allocations for key agricultural inputs, such as diesel fuel and fertilizers, as well as the distribution of basic foodstuffs through its marketing organisations. Since 1965, the main objective of national food policy has been to ensure that food shortages do not cause excessive rises in consumer prices. Earlier, in the 1950s and early 1960s, food policy was aimed more towards keeping the price of cereals steady, with minimum direct government intervention in the market. However, imports of foodgrains, particularly from United States of America, played a major role in price policy in India during the mid-1950s and 1960s (Lele, 1971). A large inflow of wheat under the PL480 food aid programme resulted, which was used exclusively for domestic consumption. This reliance on food aid clearly pointed to the nation's inability to stock foodgrains for lean years of agricultural production, and the price of domestic foodgrains continued to rise (Rath and Patvardhan, 1967). After this experience, government policy changed in the mid-1960s, so that achieving self-sufficiency in foodgrains became an immediate, urgent concern for agricultural policy. Fundamental to this strategy was the promotion of high yielding crop varieties (Sarma, 1981). With this aim in mind, four main mechanisms have been used by the national government to regulate agricultural activities. These are: (a) the food zones policy; (b) the Public Distribution System; (c) the Essential Commodities Act; and (d) agricultural price policy.

A key feature in the evolution of the Indian agricultural system is that restrictions have at times been placed on the movement of grain between regions, with the procurement of foodgrains in surplus districts being regulated, followed by national direction over their distribution and ultimately their sale at reduced prices through a rationing system in urban areas; all of which is accompanied by administrative control over grain traders, so they cannot purchase and sell grain at higher prices (and so get around government efforts to channel surplus grain to needy areas and people). Lele (1971) found that in 1966 most of the wheat that the national government procured through this process came from the Punjab, and was distributed to the major states of deficiency, which were Bihar, Uttar Pradesh and Rajasthan, in addition to major urban centres in Maharashtra and West

Bengal. This foodgrain procurement programme generally relied on market incentives, but on some occasions the government intervened through a 'zonal marketing policy'. This was where geographical restrictions were imposed on foodgrain movements within the country. Food zones were territorial units, in which the free movement of foodgrains was permitted, but the movement of foodgrains out of these territorial units was controlled by the national government. These zones were mainly formed for rice and wheat, with large multi-state zones being created for these crops between 1957/58 and 1963/64. For wheat, the Punjab fell into Zone 1, which also included Himachal Pradesh, and Delhi. For rice, the Punjab fell into the northern zone along with Delhi and Uttar Pradesh. In 1964/65 these larger wheat and rice zones were replaced by single-state zones, which continued to be used until 1975/76, when zonal restrictions were abandoned because they were felt to increase disparities in market prices (Kahlon and Tyagi, 1983). Today, state price inequities are smaller, and there is a free flow of foodgrains over the whole of the country. However, although farmers are free to sell their produce anywhere in India, extra subsidies or bonuses are available for producers in surplus states who sell their produce to government agencies within their own state. On account of these subsidies, few farmers sell their produce outside their own states, although such subsidies are only available in a limited number of states (viz. the surplus producers).

A general concern for maintaining low food prices is also seen in the creation of licenses under the Public Distribution System, which are regulated by the Essential Commodities Act of 1955 (India Government, 1991). This Act controls the supply and price of essential commodities which are sold to the general public by fair price shops. For foodstuffs, the items covered by this Act include edible and non-edible oils, sugar-cane and rice, with some commercial crops like cotton also being regulated in this way. Bhatia (1988) has pointed out that over 80% of food supplies within the Public Distribution System are provided by the northern states of India's so-called Green Revolution belt (which comprises Punjab, Haryana and Uttar Pradesh). This system has been at the centre stage of national agricultural policy, which has shown great concern for keeping down agricultural/food prices to feed the urban working class (Lipton, 1982; Kahlon and Tyagi, 1983; Kumar, 1988; Bhatia, 1992). This is true not simply for food, but also for essential agricultural inputs. Thus, the national government has declared that fertilizer is an 'essential commodity', so a licence is needed for the distribution and quality control of fertilizer, while the movement of fertilizer between states is also regulated by the national government.

It is nevertheless the case that at least since the mid-1960s, national agricultural price policy has usually been strongly influenced by considerations of technological change in the agricultural sector. Hence, the formulation and implementation of a high yielding crop varieties programme in 1966/67 had a major impact on national agricultural policies, with marketing provisions being enhanced by the introduction of fixed procurement prices, alongside government guarantees to purchase all farm produce. Since then, the national government has purchased all grain offered to it at its 'procurement price' (however, this is a lower price than that which operates in the Punjab, for in government-designated surplus producer states extra subsidies are offered if sales are made to the government rather than selling in the open market ; Westley, 1986). As part of this programme, the government created the Agricultural Price Commission in 1965 (which was later renamed as the Commission for Agricultural Costs and Prices). This Commission was set up to advise the national government on policy for the procurement of farm commodities, as well as to make recommendations about appropriate support prices for the main agricultural commodities of the nation (wheat, rice and cash crops like cotton, jute, sugar-cane and groundnuts). In 1977/78, support price procedures were extended to oil seeds (rapeseed, mustard, soyabean and sunflowers; Kahlon and Tyagi, 1983). Prices for other agricultural commodities are not fixed by the national government (Grewal and Rangi, 1986); although it should be noted that technically this situation exists for all farm products, as the national government's 'support prices' are in reality only recommendations. In fact, the chief ministers of states have the power to modify these suggested prices by setting a higher level if they wish to encourage production of a particular commodity. Even so, the price the national government sets as the support price is critical, as this is the price that is paid by consumers for foodgrains in the Public Distribution System, with most grain that is produced ultimately having to be traded through the Public Distribution System. However, the significance of the Agricultural Price Commission for agricultural policy is not restricted to making price recommendations, for it also has a significant part to play in non-price dimensions of agrarian policy, including regulations on bank advances, adjustments to export and import policies, and making recommendations for encouraging farm productivity improvements. According to both Bhatia (1988) and Bhalla (1992), the primary reason for this array of policy measures was to promote the diffusion of benefits derived from the Green Revolution from the northern states to the rest of the country.

The actions of the Agricultural Price Commission are complemented by those of the Food Corporation of India, which undertakes the purchase, storage, transport and distribution of foodgrains in the country. The Public Distribution System is also organised by the Food Corporation of

India, which acts as a wholesaler, and through the running of fair price shops also takes the role of retailer. For instance, although the Punjab state procurement agencies may actually be the institutions that procure agricultural produce, the entire market arrival of wheat eventually goes to the Food Corporation of India (to create the central pool), which then follows national government guide-lines and sees that the procured foodgrains are allocated to states that have deficiencies in food production relative to their population's requirements. A similar process exists for rice, although here private traders are able to keep 25% of their purchases, with the rest going to the Food Corporation of India.

A further element of national policy is seen in a desire to spread the benefits of mechanisation to a large number of farmers, and particularly to those who are not able to afford costly machinery. To this end, the Agro Industries Corporation was established (in 1966 in the Punjab) to distribute tractors and other agricultural machinery on a hire purchase basis. The Corporation provides repair, servicing and custom hiring facilities to farmers. Beyond this, the government controls the distribution and sale of tractors through the Tractors (Distribution and Sale) Control Order, 1971, which seeks to ensure an equitable distribution of tractors at fixed prices throughout the country. For the import of tractors, the State Trading Corporation of India acts as the sole agency.

These key features in the structure of government control and support came to increasingly dominate the agrarian scene after Independence. In fact even following recent changes in the direction of economic policies consequent upon the election of the Congress Party in 1991, and the appointment of Dr. Manmohan Singh as Finance Minister, the Indian government has not made critical changes in central features of its agricultural policy. This does not mean that no changes have occurred. For instance, since 1991, when a new 'Structural Adjustment Programme' (SAP) was introduced, subsidies for food and fertilizers have been removed. Moreover, not only does the SAP prescribe the removal of food subsidies, which provide cheap supplies for the Public Distribution System, but it simultaneously recommends the liberalisation of food imports. This policy has been highly controversial, as it is argued that the main beneficiaries of the SAP are powerful transnational companies (Economic Times, 2 October, 1993, p5). (This of course is an argument that has been repeated in many other Third World nations; see Valdes, 1986; Staatz and Eicher, 1990).

Even noting these changes, data collection for this thesis was undertaken prior to the time when these new policies had become effective, yet the dominant feature of National Agricultural Policy since 1991 has not changed, in that agricultural activities are still performed under the direct control of the national government. Any surplus farm produce is not left within states so they can establish agro-based processing industries to soak-up their extra output. It might be expected, therefore, that spontaneous growth linkages between developed agriculture and agro-based manufacturing would not have been likely to have occurred even in those states that produced a surplus in farm commodities. However, this situation is more likely to be found for medium/large-scale factories than for small-scale industrial plants. Principally this arises because there are still opportunities for processing farm commodities both for markets within states and, for some commodities (e.g. rice-shelling), prior to the export of the commodity to another state. However, the prospects of medium/large-scale factories engaging in local market opportunities is constrained by government regulations. To appreciate the more limited potential for links developing between agricultural production and medium/large-scale factory location, we need to understand how the national government has directed manufacturing activity. Hence, the National Industrial Policy is discussed in the next section, to establish how manufacturing growth is influenced by national policies.

National Industrial Policy

In India, by law of Parliament, the legislative powers relating to manufacturing are assigned to the national government, with legislation on trade and commerce, and on the supply and distribution of manufacturing products, being enacted by either states or the centre (although foreign trade is exclusively a national government concern). Government regulation is exercised through the licensing and registration of private industrial undertakings. In its dealings with manufacturing industries, the government divides the industrial structure into two major parts: (a) medium/large-scale manufacturing plants; for which industrial licensing is governed by the Industries (Development and Regulation) Act, 1951; and, (b) small-scale manufacturing plants, which are guided by the Indian Factories Act, 1948.

The critical differences between these two sectors is that the medium/large-scale manufacturing sector is controlled by a licensing policy, which gives the government control over the location, expansion and establishment of private industrial undertakings (Misra and Natraj, 1981; Rede, 1992). As such, the national government can channel large-scale investments into desired economic sectors, in order to promote balanced regional development, to protect small-scale manufacturing operations or to prevent the concentration of economic power in a few hands (Bhalla, 1986). The industrial licensing framework controls not only entry into manufacturing, and the expansion of capacity once entry has been achieved, but also the technology-mix and the import content of production practices (Ahluwalia, 1991). The Indian government exerts significant additional influence on production through the provision of key infrastructural facilities, such as railways, ports and roads, along with significant public ownership in key manufacturing industries, like steel, fertilizers, textiles, sugar and some branches of heavy capital goods industry (Singh, 1989).

Immediately after Independence, manufacturing policy emphasised the advancement of manufacturing sectors that were already well established, along with the promotion of new undertakings in the same sectors. A Lok Sabha Secretariat (1985) report points to this, when noting how, after the adoption of the Constitution, the first formal national industrial policy in 1956 (a revision of the Industrial Policy Resolution of 1948) laid stress on accelerating the speed of heavy industrialisation in the public sector, along with encouraging the growth of co-operatives. In 1956, capital was scare and the base of entrepreneurship was not strong. Hence, the states were assumed to take direct responsibility for industrial development (India Ministry of Industry, 1991). While there have been several changes in industrial policy since then, most of these adjustments have been concerned with increasing or decreasing the exemption limit for an investment which needs a licence (thus redefining the distinction between small-scale and medium/large-scale manufacturing plants), along with redefining the demarcation of areas for participation by the private sector.

Otherwise, changes to industrial policy have had a specific intention. The 1973 Industrial Licensing Policy identified high priority industries where investment from large industrial houses and foreign companies would be permitted. In 1977 a policy adjustment attached great importance to balanced regional development. The government also emphasised the need to strengthen the interaction between the agricultural and manufacturing sectors, and the role of small-scale factories and cottage industries was recognised. These aspects of industrial policy were again restated in 1980, when the government announced its intention to correct regional imbalances by a planned and government-aided dispersal of manufacturing, along with preferential treatment for agro-based manufacturing. In this 1980 policy statement attention was focused on the need to promote competition in the domestic market, on technological upgrading and the modernisation of production processes, and on encouraging foreign investment in high technology areas. In line with restating an emphasis on encouraging agro-based industries in 1989, a number of fiscal concessions were announced for the food processing and packaging industry. From then on established co-operatives with a turnover of more than one million rupees were freely permitted to have technology and marketing tie-ups with foreign companies in the agro-processing area, provided they had the required licence to start their factory and had registered with the Department of Food Processing.

The national industrial policy was then modified in 1991, when the national government decided to take a series of initiatives with respect to policies relating to industrial licensing, foreign investment, foreign technology agreements and government owned industries. Most importantly a change was introduced that allowed for the quick clearance of foreign equity participation proposals (for which prior government approval is no longer required if foreign equity brings imported capital). While freeing Indian industry from some official controls, opportunities for promoting foreign investments in India were also to be exploited. Thus, the new industrial policy exempted all new manufacturing plants from obtaining licences if the investment in fixed assets was less than 25 million rupees, with a higher limit of 75 million if the plant was located in a (nationally defined) 'backward area' (Rede, 1992). At the same time, general approval was granted for any direct foreign investment of up to 51% equity (India Ministry of Industry, 1991). Even so, limits were not completely removed from foreign investment, for official guide-lines divide industries into three groups: (a) those in which foreign investment is allowed; (b) those where foreign investment is barred but technical collaboration is permitted; and (c) those where no foreign collaboration is permitted. Foreign investment and collaboration are generally allowed only in 'high tech' industries. In the case of medium and 'low tech' industries, technical collaboration is permitted but no foreign investment is allowed (Bhalla, 1992). In essence, industrial licensing is only compulsory for sugar, coal and lignite, petroleum, animal fats and oils, wood products, alcoholic drinks, tobacco, leather products, motor cars, paper, defence equipment, hazardous chemicals, drugs and pharmaceuticals, entertainment electronics, fertilizers and pesticides, domestic refrigerators, dishwashing machines, microwave ovens and air-conditions (and compulsory licensing provisions do not apply with respect to small-scale units manufacturing any of these items).

In this regard, the Indian government has been consistent over time in seeking to encourage small-scale manufacturing activity, with separate guide-lines for this sector as early as the Factories Act, 1948. The main purpose of this Act was the approval and registration for a site on which a small-scale factory was to be situated (along with ensuring that health and safety regulations were met, that approval was gained for an extension to a factory building, etc.), with these provisions restated in the Amended Factories Act, 1987 (India Government, 1987). The quantitative definition of small-scale manufacturing has been designed to separate such units both from traditional village and handicraft industries and from medium/large-scale manufacturing, although the precise definition of small-scale units has been subject to change. The first official definition of these units was adopted during the 1950s. Then it covered those units which employed less than 50 workers a day if they used electric power or those plants with less than 100 workers a day that did not use electric power. Both these types of plants had to have a fixed investment not exceeding 500,000 rupees. The quantitative definition of small-scale unit has changed many times since the 1950s. In 1966, for example, a small-scale factory could have upto 750,000 rupees in fixed capital in plant and machinery. This criterion was changed to 1.0 million in 1975, 2.0 million in 1980 and 3.5 million in 1985. The most recent definition started in 1991, which specified that investment in fixed assets in plant and machinery should not exceed 6.0 million rupees (India Ministry of Industry, 1992).

To promote small-scale manufacturing units, a Small Industries Development Board was set up in 1954, with responsibility for advising the Government of India on the overall planning and coordination of programmes for the development of small-scale manufacturing in the country (e.g. over the supply of credit and raw materials). This organisation covers a variety of different types of small-scale manufacturing, which fall under the following organisations: the Khadi and Village Industries Board, the Small Industries Development Board, the All India Handlooms Board, the Coir Board, the All India Handicrafts Board, and the Silk Board. Further support for these sectors came with the creation of The National Small Industries Corporation in 1955. This supplies machinery on an easy instalment basis, as well as providing technical know-how and assistance in marketing. Moreover, following national government directions in 1977, District Industries Centres (DIC) were set up in every district of India, to act as a focal point for guiding and assisting the growth of small-scale manufacturing throughout each district. Small-scale units which desired any government assistance are required to register with their District Industries Centre. These centres have qualified personnel in technology, marketing, raw materials and training, and are headed by senior government officials. However, not too much should be made of national government involvement, as the development of small-scale manufacturing in India is primarily the responsibility of the individual states. Only basic policy directions are formulated at the national level, with small-scale manufacturing investment largely coming from the private sector. Nonetheless, small-scale industrial units have been recognised as a national priority sector and banks have been advised by the national government to give special attention to the credit requirements of these establishments (Mishra and Sharma, 1986).

The key conclusion from this review of Indian industrial policy is that, for medium/large-scale enterprises, prior to recent changes, both locational and productive decisions were largely directed by the planned policies of the Indian government. As a consequence, links between local raw material supply and manufacturing activity were often weak. Thus, cotton mills have been set up in Gujarat and Maharashtra which rely on good quality cotton production in Punjab (with cotton procured by the National Cotton Corporation), and the Punjab is still a major supplier of raw cotton to the spinning mills in both of these states (Punjabi Tribune, 30th November, 1992, p3). Only in the small-scale manufacturing sector has there been a degree of freedom in locational and production decisions that enables them to 'spontaneously' respond to opportunities presented by the farm (or other) sector(s).

Five-Year Plans

In India, a five-year planning cycle for national economic policy has been the norm since Independence. In terms of procedure, each state prepares its own plan, which is undertaken with central assistance so as to conform to the overall objectives of the national plan. At the same time, the Indian Union influences regional growth patterns through financial transfers from the central government to each state government. The states receive central assistance by taking a share of national taxes and duties, in addition to receiving special grants and loans. These federal transfers are made through three main channels: the Finance Commission, the Planning Commission and the central ministries (Shandilya, 1991). It follows that development efforts in India must be seen as being centrally directed, for economic planning, sectoral resource allocation, development outlays, and fiscal and monetary policies are all controlled by the national government; with each being an important external influence on regional development.

This is not to say that the central position of the national government in economic planning downgrades the role of state governments. On the contrary, they have a critical part to play in identifying local development potential and in providing administrative and financial support for local development programmes. Hence, economic, social and development services for agriculture, small-scale and cottage industries, public health, education, and general law and order problems are primarily the concern of the states. Not surprisingly, then, when writers refer to total plan expenditure in a state, this consists of spending by the national government and its agencies, which is called Central Plan expenditure, as well as spending incurred by the states, which is termed State Plan expenditure (e.g. Thimmaiah, 1985). Within this framework, inter-state trade and commerce, the formation of trading corporations (excluding cooperatives), scientific research and the establishment of technical institutions, are all national government matters (Lok Sabha Secretariat, 1985).

Most evidently, the role of the national government in promoting economic advancement is most visible in the nation's five-year plans. Not only is the economic planning system in India centralised, with state plans forming an integrated part of the national plan, but there is a heavy reliance on budgetary allocations in promoting economic sectors in the planning process (Wanmali, 1984). Yet, in the Indian federal system, most structural reforms fall under the state sector, with the national government restricted to offering incentives and guide-lines for action. Even where the national government has a specific role to play, the implementation process is generally a state responsibility. That being said, states must operate within the basic structure laid down by the national government. Consistent with general trends in government policies, in providing the basic framework for future development in a series of five-year plans, the public sector was expected to play the leading development role, with the private sector being guided in desired directions by government control and incentives (Griffin, 1989).

The process of planning in India began in 1951. The first five-year plan (1951/52-1955/56) focused largely on promoting improvements in agriculture. This meant that priority was assigned to agricultural development and the expansion of consumer goods industries. The total public outlay on agriculture in the first five-year plan was 37.2% of total plan spending. But in the second plan this was reduced to 23.1%, and was 24.9% in the third plan. By comparison the allocation to manufacturing increased from 8.4% in the first plan to 31.4% in the second plan (Roy, 1990). This shift marked a change in emphasis in the second and third five-year plans (1956/57-1960/61 and 1961/62-1965/66), with the highest priority going to rapid industrialisation; particularly for the development of basic and heavy industries. At this time the Soviet model of industrial development, and also the socialistic pattern of development, were specifically built into five-year plans (Misra and Natraj, 1981). Then, in the fourth-five year plan, the issue of balanced regional development was advanced. By the time of this fourth plan, the Indian government had returned to placing more emphasis on agricultural production, with promotion of the adoption of Green Revolution technologies adopted as a conscious policy (e.g. Griffin, 1989; Gautam, 1990).

Indicative of this change in emphasis, the Indian agricultural sector saw its share of total plan outlay standing at 37.2%, 69.0%, 29.0% and 29.1% in the fourth, fifth, sixth and seventh five-year plans, respectively. By contrast, 5.1%, 4.3%, 2.5% and 4.9% of spending was accounted for by the manufacturing sector (India Planning Commission, various issues). Yet, while the national government's investment priorities favoured the agricultural sector, during each of the plan periods growth trends were always higher in the manufacturing sector (Table 3.1). Moreover, since the fifth five-year plan, the rate of actual growth in national income has paralleled the growth rate in manufacturing production rather than the growth rate in agricultural production.

However, while spending on the five-year plans differed between economic sectors, it did not reveal sharp variation across the states. This is because the inter-state allocation of national assistance was made on the Gadgil formula, which links payments to state standing for population, per capita income, tax effort relative to per capita income, special problems within

Table 3.1
Average Percentage
Sectoral Growth Trends in India
(constant 1980/81 prices)

Plan Period	National Income	Per Head Income	Agricultural Production	Manufacturing Production
1st Plan (1951/52-1955/56)	3.6	1.7	4.1	7.3
2nd Plan (1956/57-1960/61)	3.9	1.9	4.0	5.6
3rd Plan (1961/62-1965/66)	2.3	0.1	1.4	2.0
4th Plan (1969/70-1973/74)	3.3	0.9	2.9	4.7
5th Plan (1974/75-1978/79)	4.9	2.6	4.2	5.8
6th Plan (1980/81-1984/85)	5.4	3.2	3.5	6.6
7th Plan (1985/86-1989/90)	5.5	3.3	3.6	6.5

Source: The Economist Intelligence Unit (1992).

a state, and commitments with respect to major continuing irrigation projects (Misra and Natraj, 1981). Since 1971, arranging the states of India in rank order by population, we find the Punjab is always in 14th position (with Uttar Pradesh standing in first place; Census of India, 1971, 1981 and 1991). Hence, out of total national outlays, 29.4% of agricultural investment went to Uttar Pradesh and Maharashtra in fourth five-year plan, with the Punjab lying in 11th place in the rank order of agricultural spending allocations to states (Table 3.2). A similar trend is found in the fifth, sixth and seventh five-year plans, with Uttar Pradesh and Maharashtra again having the highest recipient positions.

For manufacturing, the geographical distribution of five-year plan outlays has likewise not varied greatly over time. Here, the priority state

Table 3.2

Five-Year Plan Outlays to the Agricultural Sector in India by State
(percentage of national outlay)

States	4th Plan (1969-74)	5th Plan (1974-79)	6th Plan (1980-85)	7th Plan (1985-90)
Andhra Pradesh	6.2	7.0	7.5	8.4
Assam	3.6	2.1	2.2	3.0
Bihar	9.4	7.6	10.1	9.5
Gujarat	8.6	7.4	9.9	9.8
Haryana	3.0	4.4	4.7	4.1
Karnataka	7.7	5.6	5.3	4.8
Kerala	4.2	2.9	3.8	3.3
Madhya Pradesh	7.4	10.3	9.5	11.4
Maharashtra	14.5	13.1	11.8	12.1
Orissa	3.0	3.5	4.2	4.4
Punjab	3.7	4.2	3.8	3.3
Rajasthan	2.3	5.0	3.9	4.6
Tamil Nadu	6.6	5.4	3.8	3.6
Uttar Pradesh	14.9	14.3	13.2	14.1
West Bengal	4.9	6.9	6.2	3.5

Source: India Planning Commission (various).

has always been Uttar Pradesh, followed by Tamil Nadu and West Bengal (in the fourth and fifth five-year plans), or by Maharashtra in sixth and seventh five-year plans (Table 3.3). The Punjab has occupied the 11th or 12th place in all plan periods.

Analysis of the five-year plans reveals that, to some extent, the distribution of national resource allocations can be accounted for simply by the population size of a state. However, central allocations are only one part of the financial commitments under a plan, for total plan expenditure in a state includes Central Plan expenditure and State Plan expenditure. This means that wealthier states are able to contribute more of their own resources to a plan, so that per capita plan expenditure is quite uneven across states. This is very evident for the Punjab, which, in terms of its per capita plan expenditure always stood somewhere in the first to third rank order position during all plan periods (Table 3.4). As Bhalla (1992) has argued that the Punjab has incurred high per capita expenditure because of its own resource commitments, for since 1968 the Punjab has always had the highest per capita tax revenue of any Indian state (Table 3.5). It can be concluded, therefore, that the Punjab creates for itself the resources that give it the highest development spending. For instance, from 1966/67 to 1990/91 the contribution of grants from the national government to plan expenditure in the Punjab only accounted for between 6.0% and 17.3% of total plan spending in the state (Punjab Economic Adviser to the Government, Statistics of Public Finance, annual).

Table 3.3

Five-Year Plan Outlays to the Manufacturing Sector in India by State (percentage of national outlay)

States	4th Plan (1969-74)	5th Plan (1974-79)	6th Plan (1980-85)	7th Plan (1985-90)
Andhra Pradesh	6.1	6.4	6.8	8.7
Assam	6.7	2.8	2.2	2.9
Bihar	5.2	5.4	4.7	6.0
Gujarat	5.6	7.2	9.0	7.2
Haryana	3.1	1.8	1.0	1.6
Karnataka	6.1	5.9	8.0	6.9
Kerala	7.5	8.4	9.9	5.8
Madhya Pradesh	5.0	3.7	3.2	4.6
Maharashtra	6.9	8.7	11.9	10.2
Orissa	5.8	2.6	3.4	3.9
Punjab	5.5	3.5	5.5	3.4
Rajasthan	1.8	5.3	5.8	5.3
Tamil Nadu	13.1	8.9	8.3	7.9
Uttar Pradesh	15.5	19.1	8.9	16.7
West Bengal	6.6	10.3	11.2	8.8

Source: India Planning Commission (various).

Table 3.4

Per Capita Five-Year Plan Expenditure in India by State
(in rupees)

States	4th Plan (1969-74)	5th Plan (1974-79)	6th Plan (1980-85)	7th Plan (1985-90)
Andhra Pradesh	96.8	289.8	575.2	852.0
Assam	130.8	240.5	609.5	875.0
Bihar	84.2	185.2	404.0	622.0
Gujarat	201.7	443.2	1,077.8	1,538.0
Haryana	352.6	559.2	1,120.7	1,812.0
Karnataka	126.2	305.6	683.3	814.0
Kerala	154.8	275.4	609.3	724.0
Madhya Pradesh	112.9	290.8	702.7	1,148.0
Maharashtra	197.2	450.3	988.0	1,458.0
Orissa	112.3	256.0	578.5	900.0
Punjab	312.7	626.7	1,051.1	1,729.0
Rajasthan	118.1	281.3	593.1	714.0
Tamil Nadu	132.8	248.5	716.8	1,065.0
Uttar Pradesh	138.4	288.0	557.2	810.0
West Bengal	81.2	241.2	426.8	655.0

Source: Bhalla (1990).

Table 3.5

Per Capita Tax Revenue in India by State
(in rupees)

States	1968/71	1978/81	1988/91
Andhra Pradesh	35.8	139.4	528.8
Assam	28.8	77.4	316.2
Bihar	25.3	86.1	291.2
Gujarat	44.5	179.9	648.0
Haryana	47.8	202.1	677.0
Karnataka	41.4	159.2	595.2
Kerala	40.8	158.0	565.4
Madhya Pradesh	30.2	108.7	410.7
Maharashtra	58.2	205.6	717.9
Orissa	24.8	86.0	366.3
Punjab	61.6	231.0	707.2
Rajasthan	31.7	108.2	387.4
Tamil Nadu	43.4	153.5	611.4
Uttar Pradesh	26.4	96.7	337.0
West Bengal	40.1	136.9	512.9

Source: Punjab Economic Adviser to the Government, Statistical Abstract of Punjab (annual).

Having discussed national agricultural and industrial policies and five-year plans, it can be concluded that both national policies and five-year plan expenditure have not allowed the states with surplus agricultural raw materials to freely promote allied manufacturing activities within their state. So areas with high agricultural growth have not necessarily been favoured as sites for medium/large-scale agro-based manufacturing plants. This does not mean that high agricultural growth areas did not induce spontaneous growth linkages with agro-based manufacturing, for this could have occurred in the small-scale manufacturing sector, where direct government control is weaker. Whether this is the case or not for the agriculturally developed state of the Punjab is the main theme of this research. In order to place the Punjab in the context of the major states of India, the remainder of this chapter investigates general economic development levels across the Indian states, along with their production levels in agriculture and manufacturing.

Economic Development Levels in the Indian States

General development indicators (like per capita income, consumption expenditure, and the population falling below the poverty line) cannot be regarded as comprehensive measures of state economic performance, but individual economic indicators do help us assess relative rates of growth across states (as well as informing us about structural changes within the economy). Seen at the national level, the indices of net national product and per capita net national product for India show considerable increases between 1950/51 to 1990/91 (Table 3.6), with particularly sharp increases taking place during the 1980s in both net national product and per capita net national product.

This considerable increase is equally reflected in state per capita income growth (Table 3.7), even if per capita income still varies significantly across states. Since 1968, the Punjab has always recorded the highest per capita income of any state in India, followed by Haryana, Maharashtra and Gujarat. Even though per capita income has improved considerably for rest of the Indian states, for most states the absolute income level is below the national average (Table 3.7).

Table 3.6

Index of Net National Product in India
(at 1980/81 prices)

Period	Net National Product	Per Capita Net National Product
1950/51	100.0	100.0
1955/56	119.4	109.0
1960/61	144.9	119.8
1965/66	162.5	120.3
1970/71	203.2	134.8
1975/76	235.9	139.5
1980/81	273.6	144.7
1985/86	343.7	163.4
1990/91	456.0	195.1

Source: India Ministry of Finance (1993).

However, economic development is not only seen in higher growth in per capita income but also in reduced levels of poverty (Table 3.8). In the Punjab, the percentage of the population living below the poverty line has been the lowest for any state in India since 1970/71 (poverty in India is measured in terms of the consumption expenditure of each household, with

Table 3.7

Per Capita Income in the Indian States
(in rupees, at current prices)

States	1968/71	1978/81	1988/91
Andhra Pradesh	490	1,171	4,100
Assam	553	1,115	3,132
Bihar	406	786	2,275
Gujarat	601	1,564	5,403
Haryana	703	2,051	6,167
Karnataka	493	1,245	4,317
Kerala	505	1,116	3,315
Madhya Pradesh	524	982	3,139
Maharashtra	698	2,029	6,511
Orissa	467	851	2,979
Punjab	881	2,577	7,528
Rajasthan	468	1,112	3,436
Tamil Nadu	574	1,219	3,593
Uttar Pradesh	487	1,056	3,134
West Bengal	552	1,406	4,222
India	562	1,385	4,356

Source: Punjab Economic Adviser to the Government, Statistical Abstract of Punjab (annual).

per capita consumption expenditure generally being accepted as an appropriate indicator of levels of living in different states). These consumption figures are available from the National Sample Survey, which collects information on consumption expenditure per person over a 30 day period. For this study, these data were available for all states for the years 1972/73 and 1988/89 (the only periods for which information of this kind was available to this researcher, after extensive searching of library resources in London and the Punjab). Within National Sample Survey data presentations, information is provided for 12 consumption categories, with food and processed food items listed under the heading 'agricultural products' (termed 'food items' in Table 3.9). For our purposes, non-agricultural products are

Table 3.8

Percentage Population Living Below the Poverty Line in the Indian States

States	1970/71	1977/78	1988/89
Andhra Pradesh	41.0	45.4	31.7
Assam	..	..	22.8
Bihar	59.0	57.8	40.8
Gujarat	43.8	43.1	18.4
Haryana	..	23.2	11.6
Karnataka	47.2	53.1	32.1
Kerala	62.0	47.4	17.0
Madhya Pradesh	52.9	61.6	36.7
Maharashtra	46.6	60.4	29.2
Orissa	65.0	67.9	44.7
Punjab	23.6	13.2	7.2
Rajasthan	41.8	33.5	22.4
Tamil Nadu	57.3	56.3	32.8
Uttar Pradesh	40.6	49.8	35.1
West Bengal	70.1	58.3	27.6
India	49.10	51.20	29.9

.. data not available

Source: Ahluwalia (1978); Sarvekshana (1981); India Ministry of Finance (1993).

aggregated under the heading 'non-food' items. Viewed in terms of average per capita expenditure, for both 1972/73 and 1988/89 the Punjab was the first state in India for spending on both food and non-food products (Table 3.9).

The Punjab then has the highest standing of any state in the nation in terms of general indicators of economic development. To what extent this state has contributed its farm produce and agro-based manufacturing production to the nation, or if both agriculture and agro-based manufacturing have expanded together in Indian states, are the two main themes of the following discussion.

Table 3.9

Average Per Capita Consumption Expenditure by State
(in rupees per month)

States	Food Items		Non-food Items	
	1972/73	1988/89	1972/73	1988/89
Andhra Pradesh	33.7	122.1	14.4	92.1
Assam	37.0	142.0	14.3	76.8
Bihar	37.2	125.3	13.4	65.1
Gujarat	41.0	134.4	14.7	85.9
Haryana	44.6	152.6	24.4	107.8
Karnataka	35.8	124.5	15.4	78.3
Kerala	33.8	149.6	16.5	99.4
Madhya Pradesh	34.1	115.0	17.2	78.7
Maharashtra	36.9	138.0	21.4	103.4
Orissa	33.5	127.8	15.2	74.1
Punjab	47.0	161.2	29.3	120.5
Rajasthan	40.3	141.3	17.6	100.2
Tamil Nadu	30.1	127.5	15.0	83.7
Uttar Pradesh	32.0	116.9	15.4	84.6
West Bengal	36.8	142.0	16.6	77.3
India	36.5	132.2	17.3	88.9

Food items include cereals, gram. pulses, milk and milk products, edible oil, meat, egg, fish, vegetables, fruits, sugar, spices, beverages.

Non-food items include tobacco, fuel and light, clothing, footwear, rents, taxes, durable goods, and other services.

Source: Sarvekshana (1979, 1991).

Agriculture and Agro-based Manufacturing in the Indian States

The introduction of high yielding crop varieties in the mid-1960s enabled India to achieve a fair measure of self-sufficiency in foodgrains, as well as promoting an agrarian growth strategy based on Green Revolution technologies (Bhalla, 1986). Before this point in time, national economic wealth in India was determined principally in the agricultural sector, as it contributed the largest component of the Gross Domestic Product (Table 3.10). Despite the introduction of Green Revolution technologies, since the 1960s the manufacturing sector has expanded at a faster rate than the agricultural sector, although even today national output is more heavily reliant on agriculture than on manufacturing.

Table 3.10

Sectoral Distribution of the Gross Domestic Product in India (percentage)

Period	Agriculture	Manufacturing
1950-55	54.9	11.8
1961-65	46.6	15.8
1971-75	42.0	16.9
1981-85	36.5	18.8
1985-90	32.8	20.0

Source: India Planning Commission (1992).

An appreciation of how Green Revolution technologies influenced the geography of agro-based manufacturing expansion in India can be approximated by comparing agricultural and agro-based manufacturing production levels in the states. For this investigation, only the principal farm crops of India are considered for farm sector (foodgrains, paddy rice, wheat, sugar-cane and cotton). It is not the intention here to present a comprehensive assessment of agricultural growth and manufacturing performance in the different states of India (indeed manufacturing output data are available on a national basis only for factories employing ten or more workers which use electric power or those employing 20 or more workers which do not use electric power). Rather, a comparative analysis is undertaken of sectoral output for foodgrains and food products, paddy rice with grain mill products, wheat with bakery products, cotton with cotton textiles, and sugar-cane with sugar (these comparisons are not ideal as food products manufacturing includes more than foodgrains, as oils, tea processing, dairy products, fruit and vegetables are included under food products, and grain mill products includes rice mills and the processing of other grains, but the data categories that are available at a national level only allow this limited analysis of 'comparable' farm and agro-industrial production).

Foodgrains and Food Products

In terms of its percentage share of total national foodgrain production in 1988/91 (that is of wheat, rice, 'jowar', 'bajra', maize, barley and pulses), the Punjab stood in second place with 11.3% of total output, coming after Uttar Pradesh which had a 20.5% share (in terms of its share of the national area under foodgrains, the figures were 4.5% for the Punjab and 16.2% for Uttar Pradesh). Yet the Punjab does not occupy so high a position for the manufacture of food products, even though its share has increased with rises in its level of crop output (Table 3.11). Despite this, the percentage share of national food products output accounted for by the Punjab did grow rapidly compared with the performances of other states. For instance, its share of the national total rose from 7.8% to 11.3% for foodgrain output and from 2.3% to 9.1% for food products manufacturing from the late-1960s to the late 1980s. No other state followed this pattern of growth for both foodgrain production and food products manufacturing. However, the coincidence of these trends within the Punjab should not be taken to indicate that there is a coming together of farm and manufacturing activity nationally. Twenty-five years after

Table 3.11

Production of Foodgrains and the Manufacture of Food Products by State (percentage share to national production)

States	Foodgrains			Food Products		
	1968/71	1978/81	1988/91	1969	1979	1989
Andhra Pradesh	7.2	8.6	7.5	7.2	8.5	10.5
Assam	2.2	2.0	1.9	6.1	5.4	4.0
Bihar	8.3	7.9	7.1	3.5	2.0	1.6
Gujarat	3.4	3.8	2.9	6.8	11.3	9.8
Haryana	4.2	5.1	5.4	0.8	2.5	2.9
Karnataka	5.7	6.1	4.0	4.4	5.4	5.1
Kerala	1.3	1.1	0.6	4.7	3.7	3.2
Madhya Pradesh	10.2	8.9	9.7	2.4	3.0	3.7
Maharashtra	6.7	8.7	7.5	21.5	19.7	18.4
Orissa	5.3	4.5	4.4	0.5	1.0	0.7
Punjab	7.8	7.2	11.3	2.3	6.9	9.1
Rajasthan	6.0	5.7	5.8	0.5	2.5	2.4
Tamil Nadu	6.3	6.4	4.6	8.1	9.6	8.4
Uttar Pradesh	18.1	18.4	20.5	19.5	11.3	15.1
West Bengal	7.4	6.6	6.9	11.5	7.4	5.0
India	*98,353	114,980	168,795	15,332	71,516	235,298

*foodgrain production in '000 metric tonnes and food products output in million rupees.

Source: India Ministry of Planning, Statistical Abstract India (annual) and India Ministry of Planning (1969, 1979, 1989).

the Green Revolution came to the Punjab, the state has moved to the position of second highest state in its foodgrain output and fifth highest in its food products manufacturing. But Madhya Pradesh, which has always performed well in foodgrains production (occupying second rank in 1968/71 and third position in 1988/91), finds its commitment to the manufacturing of food products standing much lower (occupying eleventh place in 1969 and tenth place in 1989), while Gujarat, which has consistently held a low rank for farm output (being thirteenth in 1988/91) consistently records a high position for food products manufacturing (being in fourth place in 1989). Put simply, the association that exists between state-level production for foodgrains and food products is not a strong one, and changes in output patterns over the last few decades appear to have done little to alter this situation.

Paddy Rice and Grain Mill Products

In contrast to foodgrains and food products manufacturing, production growth linkages are closer for paddy rice and grain mill products across the states. Many states have followed corresponding growth patterns for both farm output and manufacturing production since the late-1960s. For instance, the states that lost position in terms of their share of total paddy rice production also saw their share of national grain mill production fall (as occurred for West Bengal and Bihar). In fact, during the two decades after the Green Revolution, the Punjab alone saw a large increase in its share of manufactured mill produce being accompanied by notable growth in farm output. Here, paddy rice output rose from a share of the total national crop of 1.4% in 1968/71 to 9.8% in 1988/91, with the state's grain mill production growing from a 5.8% share in 1969 to a 22.8% share in 1989 (Table 3.12). Elsewhere, patterns of increase in the share taken by both sectors occurred in less extreme form for Andhra Pradesh, Haryana and Uttar Pradesh.

However, this consistency of trend is not matched by a mirror-image performance across states. In many cases a relatively high performance in farm output is matched by a relatively poor manufacturing performance (as for Bihar, Kerala and Orissa), while in others a high output of grain mill products is allied to relatively small farm output figures (as for Maharashtra and West Bengal in earlier decades and even for the Punjab).

Table 3.12

Production of Paddy Rice and the Manufacture of Grain Mill Products by State (percentage share to national production)

States	Paddy Rice			Grain Mill Products		
	1968/71	1978/81	1988/91	1969	1979	1989
Andhra Pradesh	11.5	14.4	14.6	14.0	5.6	24.1
Assam	5.3	4.6	4.5	0.0	3.6	1.7
Bihar	11.6	10.2	9.6	5.4	2.5	1.9
Gujarat	1.1	1.1	1.2	4.0	2.6	3.3
Haryana	0.9	2.4	2.6	1.8	1.6	5.3
Karnataka	5.3	4.7	3.5	3.1	3.2	3.5
Kerala	3.3	2.7	1.6	0.0	0.0	0.2
Madhya Pradesh	8.3	6.5	7.9	5.1	6.3	5.6
Maharashtra	3.8	3.9	3.4	18.8	12.4	7.7
Orissa	11.3	8.1	8.5	1.8	2.3	1.7
Punjab	1.4	6.5	9.8	5.8	14.1	22.8
Rajasthan	0.2	0.3	0.2	0.0	1.3	1.3
Tamil Nadu	11.6	11.4	8.9	3.6	9.1	5.7
Uttar Pradesh	8.6	9.6	14.5	9.6	9.2	11.5
West Bengal	15.8	13.6	9.1	27.1	26.2	3.6
India	*39,536	47,724	67,651	799	2,706	44,882

*paddy rice production in '000 metric tonnes and grain mill products output in million rupees.

Source: India Ministry of Planning, Statistical Abstract India (annual) and India Ministry of Planning (1969, 1979, 1989).

Nevertheless, compared with other linkage patterns, it is here more than anywhere else that a relatively close association exists between farm production (change) and manufactured output (change).

Wheat and Bakery Products

Examination of wheat and bakery products provides a closer potential association between farm crop and manufacturing input than foodgrains and

Table 3.13

Production of Wheat and the Manufacture of Bakery Products by State (percentage share to national production)

States	Wheat			Bakery Products		
	1968/71	1978/81	1988/91	1969	1979	1989
Andhra Pradesh	0.0	0.1	0.0	3.6	8.2	5.6
Assam	0.0	0.9	0.2	0.0	0.0	0.8
Bihar	0.7	7.1	6.6	0.0	0.5	1.7
Gujarat	4.1	3.6	2.5	0.0	3.7	4.4
Haryana	1.1	10.1	12.1	0.0	0.0	6.2
Karnataka	0.8	0.6	0.2	2.7	3.3	7.0
Kerala	0.0	0.0	0.0	0.0	0.0	0.7
Madhya Pradesh	13.0	8.4	9.2	0.0	4.1	1.9
Maharashtra	2.5	2.8	1.8	46.3	40.3	37.7
Orissa	0.1	0.3	0.1	0.4	0.0	0.8
Punjab	28.0	22.5	23.3	0.0	0.0	3.8
Rajasthan	8.5	7.8	7.5	0.0	0.0	1.5
Tamil Nadu	0.0	0.0	0.0	11.5	9.5	12.3
Uttar Pradesh	38.4	33.4	35.3	1.7	8.9	6.8
West Bengal	2.7	2.2	1.2	33.7	20.3	8.9
India	*17,311	33,955	51,122	332	1,521	4,139

*wheat production in '000 metric tonnes and bakery products output in million rupees.

Source: India Ministry of Planning, Statistical Abstract India (annual) and India Ministry of Planning (1969, 1979, 1989).

food products, for wheat and bakery products are elements of these much broader categories. The Punjab has occupied the second highest position in wheat production in the nation since the mid-1960s (Table 3.13), and has always been at the top in terms of yield per hectare for this crop (although the manner in which Green Revolution technologies have made this an attractive crop in new areas of production is also apparent; thus, while the percentage of the national cropped area that was in the Punjab or Uttar Pradesh in 1968/71 was 67.5%, by 1988/91 this figure had fallen to 51.8%; India Ministry of Planning, Statistical Abstract India, annual). Along with Uttar Pradesh, Punjab is a state which has never contributed less than one-fifth of total national wheat production since the mid-1960s, with these two states always accounting for more than half of all national production (add Haryana and Madhya Pradesh and this figure rises to 70.0% of national wheat output).

By contrast, Maharashtra has always occupied a low position for its share of national wheat production, yet it has held the prime position in bakery products manufacturing consistently. Indeed, if we take Maharashtra, Tamil Nadu and West Bengal we account for 91.5% of bakery products output in 1969, with a 1989 figure of 58.9%. These totals can be compared with those for Haryana, Madhya Pradesh, the Punjab and Uttar Pradesh, which collectively were 1.7% and 18.7% at these two dates. Very evidently, then, analysis shows that weak sectoral linkages exist for farm wheat and bakery products output across the states (Table 3.13).

Cotton and Cotton Textiles

A weak association is also found for the production of the cotton crop and the manufacture of cotton textiles. For instance, since the arrival of the Green Revolution, the share of national cotton production in the Punjab has increased from 15.5% to 20.6%, so that it had become the largest producer state by 1991 (Table 3.14). By contrast, the highest production shares for cotton textiles have always been occupied by other states. For two major producer states of the cotton crop (Gujarat and Maharashtra), it is at least true that they similarly occupy a key role in the production of cotton textiles. Thus, these two states accounted for 50.4% of farm cotton output in 1968/71 and 34.0% in 1988/91, with companion figures of 48.1% and 34.1% for textile production. Yet while the most impressive growth in cotton output was occurring in Andhra Pradesh, Haryana, Punjab and Rajasthan, for textiles it was Tamil Nadu that dominated growth trends. Thus, farm cotton output in the Punjab grew from an annual average of 0.78 million metric tonnes in 1968/71 to an annual average of 2.18 million metric tonnes in 1988/91, with production levels in Tamil Nadu being 0.33 and 0.45 metric tonnes for the same periods. Yet in 1969 and 1989 the Punjab accounted for just 2.1% and 5.1%, respectively, of national textile production, compared with figures of 12.0% and 29.5% for Tamil Nadu.

Table 3.14

Production of Cotton and the Manufacture of Cotton Textiles by State (percentage share to national production)

States	Cotton			Cotton Textiles		
	1968/71	1978/81	1988/91	1969	1979	1989
Andhra Pradesh	2.2	4.9	10.0	2.0	3.4	6.2
Assam	0.1	0.0	0.0	0.1	0.2	0.2
Bihar	0.1	0.0	0.0	0.2	0.3	0.9
Gujarat	30.3	24.9	14.6	17.3	25.0	17.5
Haryana	6.7	7.6	10.4	1.4	2.3	2.0
Karnataka	7.8	9.4	7.3	2.9	3.8	3.3
Kerala	0.1	0.1	0.1	1.9	1.8	2.1
Madhya Pradesh	6.0	3.6	3.7	4.3	4.1	3.4
Maharashtra	20.1	19.3	19.4	30.8	25.3	16.6
Orissa	0.0	0.1	0.1	0.4	0.7	1.1
Punjab	15.5	16.4	20.6	2.1	4.1	5.1
Rajasthan	3.6	6.7	9.0	2.4	4.0	5.0
Tamil Nadu	6.6	6.6	4.3	12.0	16.0	29.5
Uttar Pradesh	1.0	0.3	0.2	4.4	5.4	5.0
West Bengal	0.0	0.0	0.0	17.8	3.7	2.1
India	*5,011	7,815	10,573	18,327	47,688	96,490

*cotton production in '000 metric tonnes and cotton textiles output in million rupees.

Source: India Ministry of Planning, Statistical Abstract India (annual) and India Ministry of Planning (1969, 1979, 1989).

Sugar-cane and Sugar Mills

Of all of India's main crops, only for sugar do we find a relatively close output association between agricultural and manufacturing output across the states. States with the lowest production shares for national sugar-cane production have also contributed less to the nation's output of manufactured sugar. Thus, the five states with the smallest output levels in 1988/91 (Assam, Kerala, Madhya Pradesh, Rajasthan and West Bangal) contributed just 2.5% of national farm output and likewise counted for just 1.2% of manufactured production in 1989.

Table 3.14

Production of Sugar-cane and the Manufacture of Sugar by State (percentage share to total national production)

States	Sugar-cane			Sugar		
	1968/71	1978/81	1988/91	1969	1979	1989
Andhra Pradesh	8.8	7.0	5.2	8.0	5.4	5.9
Assam	1.1	1.1	0.7	0.0	0.0	0.0
Bihar	4.3	2.6	3.1	9.3	4.7	3.6
Gujarat	1.4	2.5	4.3	2.0	4.9	7.2
Haryana	5.6	3.5	3.1	2.1	2.2	3.3
Karnataka	6.5	7.7	8.0	4.7	8.7	6.6
Kerala	0.3	0.3	0.2	0.7	0.5	0.0
Madhya Pradesh	1.1	1.3	0.8	0.4	0.9	0.8
Maharashtra	11.5	16.1	15.7	27.6	32.6	28.6
Orissa	1.7	2.0	1.5	0.4	0.0	0.3
Punjab	4.3	3.1	2.6	1.7	1.7	2.9
Rajasthan	0.5	1.0	0.4	0.6	0.8	0.4
Tamil Nadu	8.2	11.8	10.4	10.5	6.9	10.4
Uttar Pradesh	43.7	39.2	43.5	32.0	30.7	30.1
West Bengal	1.0	1.0	0.4	0.0	0.0	0.0
India	*12,807	14,856	23,074	2,402	10,622	39,253

*sugar-cane production in '000 metric tonnes and sugar output in million rupees.
Source: India Ministry of Planning, Statistical Abstract India (annual) and India Ministry of Planning (1969, 1979, 1989).

The Punjab has not been a major producer of either sugar-cane or manufactured sugar (with its percentage share of sugar-cane production never more than 4.3%, while 2.9% has been its highest share for manufactured sugar). Amongst the large-scale producers, Maharashtra and Uttar Pradesh have consistently occupied the highest positions for both sugar-cane production and sugar manufacturing output (Table 3.14), together accounting for 55.2% of farm output in 1968/71 and 59.2% in 1988/91, compared with 1969 and 1989 shares for manufactured sugar of 59.6% and 58.7%.

Conclusion

Having discussed output growth associations for foodgrains and food products, paddy rice and grain mill products, wheat and bakery products, cotton and cotton textiles, sugar-cane and sugar mills, it appears that wheat and cotton processing plants have had a spatial distribution across the states that shows very little regard for major farm producing states. A closer association did exist between paddy rice and grain mill products production and between foodgrains and food products output, but even here the strength of association was not strong. Only for sugar-cane and manufactured sugar could a close tie between state-level farm and manufacturing output be said to exist. For the Punjab, then, even though it has been (and is) a major agricultural producer, it has generally not captured a comparable share of manufactured output (even though the state has the highest overall socio-economic standing amongst the Indian states). This pattern also holds for farm inputs. Thus, for fertilizer production, the Punjab only recorded a 3.3% share of total national production in 1979 and a 7.9%

share in 1989, despite its key role in the nation's farm economy (Bhatia, 1988; Bhalla, 1990). For agricultural machinery products it fares better, by holding sixth position in 1979 and third in 1989 (Appendix I). However, the overall picture is one in which a geographical balance in sectoral production does not exist within the Indian economy. Yet while the Punjab might have been contributing a smaller share to national agro-based manufacturing output than its farm output levels would lead one to expect, this does not mean that growth in farm production has not encouraged expansion in the manufacturing of agro-based products. Examining temporal change in both the farm and manufacturing sectors, this question of links between growth in farm and manufacturing output within the Punjab is the issue that is addressed in Chapter Four.

Chapter 4

Agriculture and Manufacturing in the Punjab: A Temporal Analysis

The last chapter revealed that the Punjab has been an economically progressive state since the 1960s, and tops almost every index of general economic performance in India, with a particularly impressive performance in the agricultural sector. Although a brief discussion was made in the last chapter on associations between agricultural and manufacturing in the different states of India, this analysis was not sufficient to take us far in establishing whether relationships between recent growth in the agricultural and manufacturing sectors are causally linked. In this chapter, the prime aim is to start building more depth of insight on this issue, in this case by investigating temporal patterns of change in production growth in both agriculture and manufacturing within the Punjab. By examining year-by-year changes in state-wide production in both sectors, the aim is to see if growth in one sector consistently preceded growth in the other, or whether their changing growth performances bore little relationship to one another. Put simply, if agricultural growth has been instrumental in accelerating growth in other sectors, particularly in manufacturing, then we should expect crop production rises to come before increases in output in allied manufacturing sectors. While it is recognised that time-lags between agrarian prompts for growth and manufacturing responses can vary by farm product, establishing that there is a general covariation in output change is an important indicator of potential causal links. Moreover, in providing temporal insights on production covariation, we not only highlight a dimension that is too often not examined in empirical investigations of causal relationships, but also offer a longer-term perspective than is possible in many studies. This is because this chapter analyses agrarian change and manufacturing expansion since the introduction of new seed fertilizer technologies during the 1960s. The investigation itself mainly concentrates on the aftermath of the arrival of the Green Revolution in 1966/67, which coincided with the reorganisation of the old state of Punjab, to create the present Punjab in 1966.

Before discussing sectoral linkages, it is necessary to examine agriculture and manufacturing within the Punjab separately, in order to identify patterns and peculiarities in their role in development processes. Although this chapter does not elaborate on all aspects of the state's economy, it is important to shed light on how these sectors are directly or indirectly influenced by state government policies, and benefit from infrastructural provisions within the state. For this, the first section of this chapter opens with an examination of the state's five-year plans, which provide direction to the fiscal commitments of the state government, and so effect the balance of development advantages across economic sectors. This section ends with a discussion of general patterns of economic growth within the state.

The second section of the chapter is devoted to the agrarian structure of the state. Even though the main analysis begins at the time of the arrival of the Green Revolution, to assess the impact of this innovation some attention is given to previous agricultural patterns, so as to obtain a clearer picture of development processes in the study area. After examination of agricultural production patterns from the Green Revolution to the present period, the next part of this section is assigned to identifying the marketing structure of agricultural produce in the state. Since this marketing structure partially determines the movement of farm commodities from producer to consumer (whether via manufacturer or not), an understanding of marketing arrangements is required in order to appreciate the potential for direct linkages between the agricultural sector and the rest of the economy. This discussion is followed by an interpretation of state government guide-lines for promoting agriculture within the state. Along with understanding the effects of development processes, an appreciation of forces that contribute to enhancing agricultural growth is important in order to theorise the causes of development processes.

Manufacturing production patterns will be evaluated in the third section of the chapter. This analysis seeks to evaluate the same time period as that for agricultural change. However, due to the non-availability of reliable annual data on the manufacturing sector, the time periods that can be investigated are primarily determined by the availability of statistical information. As it is common for government intervention to play a crucial role in determining the parameters of economic development, the analysis of manufacturing production change will be followed by a consideration of the role of state institutions that affect manufacturing expansion. As with the examination of the agricultural sector, the aim is to assess whether manufacturing has been particularly advantaged by state government policies, and how its potential for connections with agriculture have been conditioned by government actions.

The last section of the chapter provides a critical appraisal of agricultural performance and manufacturing expansion. Here, the investigation will focus on links between temporal change in agricultural production and the development of manufactured 'inputs' for agriculture and the processing of agricultural 'outputs' (i.e. on agro-based manufacturing).

Five-Year Plans in the Punjab

Up to 1992, economic growth in India was directed by five-year plans, with the burden of financing the Punjab five-year plans falling largely on the state government's budget (Punjab Economic Adviser to the Government, Economic Survey of Punjab, 1993). Thus, since the arrival of the Green Revolution (over the period 1966/67 to 1990/91), the contribution of grants from the national government to the Punjab only accounted for between 6.0% and 17.3% of total plan spending in the state (calculated from: Punjab Economic Adviser to the Government, Statistics of Public Finance, annual). As a consequence, while the national government does have a directing role in five-year plan implementation, it is the state government that has played the key role in financing governmental contributions to the state's economic development (Chadha, 1986).

In the Punjab, state government efforts have clearly been directed mainly toward improving the agriculture sector of the economy. In character, the main emphasis in enhancing agricultural production has been seen in efforts to expand the area under irrigation and to maximise the production of foodgrains (Table 4.1). In addition, plan investment has laid stress on improving social services, although electricity and irrigation improvements have easily taken up the major portion of total outlays during all plan periods (the share of plan expenditure on electricity and irrigation never fell below 50.0% and increased in the later plan periods so it stood at 55.5% in the fourth plan and 61.2% in the seventh plan). It should be noted that the expansion of electricity has brought considerable benefits for agriculture; as seen in the per capita consumption of electricity in the

Table 4.1

Sectoral Allocation of Five-Year Plan Expenditure in the Punjab
(percentage expenditure share)

Sectors	4th Plan (1969-74)	5th Plan (1974-79)	6th Plan (1980-85)	7th Plan (1985-90)
Agriculture & Community Development	12.0	13.2	15.2	12.5
Irrigation & Power	55.4	51.2	56.4	61.2
Manufacturing & Mining	3.2	5.0	4.1	3.8
Transport & Communication	14.9	9.3	5.7	5.5
Social Services	13.2	20.2	17.8	16.1
Miscellaneous	1.2	1.1	0.8	0.8

Source: Punjab Economic Adviser to the Government, Statistical Abstract of Punjab (annual).

agricultural sector rising from 10.67 kilowatts per hour in 1966/67 to 258.53 kilowatts in 1991/92.

More generally, Bhalla (1990) has argued that the policy measures of the Punjab government have a rural bias in their expenditure on infrastructure, in the provision of essential production inputs, such as water and electricity at highly subsidised rates, in the stabilisation of agricultural prices, in the availability of cheap loans (both directly and through cooperatives), in the provision of farm inputs, such as fertilizers, better seeds and insecticides, and in the organisation of agricultural research and extension. All these spending categories received a high priority in each of the fourth, fifth, sixth and seventh five-year plans (which cover the period since the Green Revolution). Spending within five-year plans on the manufacturing sector has been negligible compared to agriculture. The pattern is similar in all plan periods. One reason for this is that an emphasis on investment in heavy industry, which India's five-year plans have favoured for the manufacturing sector, has not been a plan priority for the Punjab. Indeed, the share of plan expenditure on manufacturing and mining only ever reached 5.0% (in the fifth plan) and was as low as 3.2% in the fourth plan. Punjab's development strategy, therefore, has clearly laid most stress on developing the state's dominant economic sector; namely, agriculture (Table 4.1). Theoretically, a point of interest here is the manner in which this governmental emphasis contradicts the Urban Bias Hypothesis (Lipton, 1982).

The investment pattern of five-year plans shows that the manufacturing sector always received a very small share of total investment during the plan periods. The Economic Survey of Punjab in 1990 found that there were not many opportunities for investment outside of the agricultural sector within the state (Punjab Economic Adviser to the Government, 1990). One indication of this lies in the credit-deposit ratio in the state, which is a measure of the utilisation of bank funds for investment purposes. In 1987 this was only 44.27% in the Punjab, against an all-India figure of 63.02%, with corresponding percentages in states like Tamil Nadu, Maharashtra, Karnataka, Andhra Pradesh and Orissa ranging from 79.56% to 93.49%. Thus, 55.73% of bank deposits in the Punjab were not being used for investment within state. Of course, this does not mean that the utilised 44.27% of funds were only used for agriculture and other services, yet the Economic Survey's report, along with five-year plan investment figures, clearly shows that the agricultural sector is the major priority for investment resources. According to Kainth and Bawa (1985) while the agricultural sector has provided a good deal of resources that have been mobilised by the commercial banking sector, these resources have not been used to finance industrial development within Punjab, but have flowed out of the state to finance industrial and other investments in other states (see also Bansal, 1985; Kakkar, 1989). Likewise, Bhalla et al (1990) noted that the results of their input-output analysis of the Punjab economy show that since the Punjab became a surplus producer in agricultural commodities, a considerable sum of savings from within the state has come to be used for investment outside the state. Even so, those economists who have worked on the state's economy have generally expressed the view that expansion in the secondary and tertiary sectors of the state has largely drawn on prosperity in the primary sector of agriculture (see Kainth and Bawa, 1985; who critically examined the fifth plan period and the annual plans of 1978/79 and 1979/80, and reported that income transfers have been from the primary to the non-primary sectors). Effectively, then, work on the banking sector in the Punjab suggests that the secondary and tertiary sectors have not expanded due to direct financial investments by the state government, but have been able to draw on a prosperous agricultural sector to help fund their expansion. Hence, the strength of (and support for) agriculture could result in farm productivity rises which (indirectly through the banking system or perhaps directly) encourage small-scale manufacturing growth.

General Economic Growth Trends in the Punjab

While discussion of general economic growth trends is not the main issue of this chapter, it is important to recognise that economic advancement helps improve the general infrastructural facilities within which agricultural growth and manufacturing expansion take place. In addition, with improvements in income accompanying economic growth, these sectors should benefit from rising consumption of the goods they produce for local markets. It follows that a temporal analysis of the sectoral composition of net state domestic product provides an important measure of structural changes in the economy that helps us visualise growth patterns. Since the onset of the Green Revolution, the per capita net state domestic product has increased from 720 rupees in 1966/67 to 9,643 rupees in 1991/92 (Table 4.2). Yet the composition of net state domestic product for the primary (mainly agriculture), secondary (mainly manufacturing) and tertiary sectors reveal notable shifts in the period 1966/67 to 1991/92, particularly in the secondary and tertiary sectors. The higher growth rate of the secondary sector during recent years shows that the manufacturing sector has been contributing at an increasing rate to net state domestic product. In contrast, the comparatively slower growth of the primary sector suggests that, over the last 25 years, despite significant agricultural growth, there has been a shift in economic emphasis toward the secondary and tertiary sectors, even though the Punjab economy continues to be dominated by the primary sector (Table 4.2).

Despite rapid growth in the primary, secondary and tertiary sectors, the primary sector continues to dominate the Punjab economy. The contribution of the agricultural sector to state income can be treated as a measure of its importance in the overall economy. In the Punjab the agricultural sector contribution to net state income ranged between 30.0% to 49.3% over the years 1970/71 to 1991/92 (Punjab Economic Adviser to the Government, <u>Statistical Abstract of Punjab</u>, annual). This contribution has always been much more than the contribution of the manufacturing sector (which ranged from 7.9% to 15.1% over this time period). But the percentage share of the agricultural sector has fallen gradually over the period, while the manufacturing share has increased.

Table 4.2

Net State Domestic Product in the Punjab
(percentage share)

Period (July-June)	Primary	Secondary	Tertiary	Per Capita NSDP(rupees)
1966/67	62.2	15.3	22.5	720
1967/68	63.0	14.4	22.6	818
1968/69	62.5	14.7	22.8	881
1969/70	61.4	15.1	23.5	945
1970/71	60.7	14.9	24.4	995
1971/72	60.0	15.2	24.8	1,054
1972/73	57.8	15.8	26.4	1,393
1973/74	62.8	13.7	23.5	1,438
1974/75	60.6	15.0	24.4	1,525
1975/76	56.7	16.6	26.7	1,593
1976/77	56.8	15.8	27.4	1,812
1977/78	55.5	16.6	27.9	1,966
1978/79	53.4	18.3	28.3	2,094
1979/80	51.1	19.8	29.1	2,361
1980/81	49.5	18.5	32.0	2,674
1981/82	49.0	19.0	32.0	3,131
1982/83	48.2	18.9	32.8	3,382
1983/84	46.7	19.9	33.4	3,673
1984/85	46.5	19.4	34.1	4,028
1985/86	45.7	20.4	33.9	4,578
1986/87	45.1	20.1	34.8	4,940
1987/88	46.2	20.2	33.6	5,719
1988/89	45.2	21.8	33.0	6,487
1989/90	45.8	21.4	32.8	7,674
1990/91	45.2	21.7	33.1	8,423
1991/92	46.5	21.4	32.1	9,643

NSDP: net state domestic product

Primary Sector: agriculture, animal husbandry, fishery, forestry, mining and quarrying.

Secondary Sector: manufacturing (registered manufacturing, medium/large and small-scale manufacturing), construction, electricity, gas and water supply.

Tertiary Sector: transport and communication, trade, storage, hotels, banking, insurance, real estate, business services, public administration, sanitary and other services.

Source: Punjab Economic Adviser to the Government, Statistical Abstract of Punjab (annual).

Primarily on the strength of the Punjab's rapidly growing agricultural production, its per capita income has consistently increased since the 1960s (Westley, 1986). Per capita income figures give a useful idea of the higher demand for goods and services, as well as higher savings that can be drawn on for future investments. At current prices, per capita income in the Punjab rose from 784 rupees in 1966/67 to 8,423 rupees in 1990/91 (or from 1,791 to 3,744 at 1980/81 prices; Punjab Economic Adviser to the Government, 1993a).

Another measure of the part that farm production plays in the economy outside of the agricultural sector is the proportion of household income that is spent for food and clothing (Singh, 1973). Due to data availability, analysis of household consumption patterns could only be undertaken for the years 1972/73 and 1988/89, but the pattern recorded for these dates is instructive. According to the distribution of monthly per capita expenditure, a major share of total household expenditure went on food items at both dates (Table 4.3). In 1972/73, for instance, food items accounted for 61.6% of monthly expenditure, with the figure for 1988/89 standing at 57.2%. Between these two years, there has been only relatively minor changes in the importance of food articles. For example, cereal consumption has shown a relative decline, while milk products have grown in importance. Reflecting this growth in milk consumption, the per capita availability of milk in the state has increased from 0.5 kilograms per person per day in 1973/74 to 0.7 kilograms in 1991/92 (Punjab Economic Adviser to the Government, Statistical Abstract of Punjab, annual). Overall, though, it is evident that the priorities attached to individual commodity groups have remained relatively stable over the last 20 years, with this conclusion extending not just to the weight attached to

Table 4.3

Average Per Capita Consumption Expenditure in the Punjab (per month)

Items	1972/73 Expenditure (rupees)	1972/73 % share	1988/89 Expenditure (rupees)	1988/89 % share
Total cereals	11.5	24.5	31.2	19.4
Gram	0.1	0.2	0.8	0.5
Pulses and products	2.3	4.9	10.3	6.4
Milk and milk products	13.2	28.1	49.4	30.7
Edible oils	2.9	6.2	13.6	8.4
Meat, egg, & fish	1.0	2.1	2.5	1.5
Vegetables	2.7	5.8	14.4	8.9
Fruits and Nuts	1.3	2.8	5.4	3.4
Sugar	6.4	13.7	14.1	8.8
Salt	0.1	0.2	0.3	0.2
Spices	1.3	2.8	5.8	3.6
Beverages & others	4.1	8.7	13.3	8.2
Food: total	47.0	100.0	161.2	100.0
Pan & tobacco	2.1	7.1	6.0	5.0
Fuel & light	4.0	13.6	20.8	17.3
Clothing	6.7	22.8	22.3	18.5
Foot-wear	1.1	3.7	5.2	4.3
Other goods & services	11.4	38.9	51.4	42.7
Rents	1.0	3.4	3.7	3.1
Taxes	0.1	0.3	0.1	0.1
Durable goods	3.0	10.2	10.9	9.0
Non-food: total	29.3	100.0	120.5	100.0

Source: Sarvekshana (1979, 1991).

individual food items but also to the balance of spending on food and non-food items.

Nevertheless, given real income rises within the state, these figures indicate that consumption gains have been achieved for food items. In responding to this increased demand, farmers efforts have been backed by substantial increments in infrastructural provision, which are not simply a manifestation of economic growth but are important elements in the agricultural transformation of the Punjab (Chadha, 1985; Chaudhri and Dasgupta, 1985; McGuirk and Mundlak, 1991). In reality, both agriculture and manufacturing (along with other sectors of the economy) have benefited from massive programmes of infrastructural development in roads. By 1980/81, 98% of all villages in the state were linked by installed roads, while between 1967 and 1991, the number of passenger vehicles on the roads increased from 782 to 72,519 for cars and from 330 to 10,235 for buses. Much investment has also been made in education and health, as indicated by the number of people per doctor falling from 2,758 to 1,514 between 1967 and 1991, while the number of educational institutions rose from 9,225 in 1967 and 16,960 in 1991 (Punjab Economic Adviser to the Government, Statistical Abstract of Punjab, annual). In essence, the general trend in infrastructural provision has aided economic advancement through improvements in transport, health and education. Alongside these public sector investments, private sector initiatives have helped create a supportive environment for economic growth. One illustration is the number of bank offices (commercial banks, co-operatives banks, post office saving banks), which rose fourfold during the period 1967 to 1991 (Punjab Economic Adviser to the Government, Statistical Abstract of Punjab, annual).

Yet one of the most basic factors that has enabled both agriculture and manufacturing to raise their productivity (and for manufacturing to locate more freely within the state), has been improvements in the supply of electrical power. Indicative of the importance of electrical supply to farm production, by 1991/92 the agricultural sector consumed 43.8% of total electric power within the state, which was a rise from its 21.6% figure of 1968/69. Consumption in the manufacturing sector has also grown, but less notably than in the agricultural sector (with its share of total consumption ranging from 31.9% to 41.3% over the years from 1968/69 to 1991/92, with the 1991/92 figure standing at 35.4%). However, given that total per capita electricity consumption in the state rose from 106.12 kilowatts per hour in 1966/67 to 607.69 kilowatts in 1990/91, this still points to significant gains in manufacturing consumption. Even so, the most spectacular increments occurred for agriculture. By 1977/78, for instance, almost all the villages in the state were electrified, with the number of tube-wells energised rising from 91,000 in 1970/71 to 622,000 in 1992. Punjab had relatively few areas under tube-well irrigation in the 1960s, but this form of farming developed rapidly after 1966/67, so that the area under tube-well irrigation increased from 982,000 hectares in 1966/67 to 2.4 million hectares in 1991/92 (Punjab Economic Adviser to the Government, Statistical Abstract of Punjab, annual).

It can be concluded that since the onset of the Green Revolution, there have been substantial changes in per capita income, along with improved transport facilities, an enhancement in banking provision and a more widespread availability of electricity. These make up elements of changes in household consumption patterns, as well as improving the framework within which manufacturing and agricultural expansion have taken place.

Changes in Agricultural Production in the Punjab

The question is, how were these advantages manifest in production changes in the agricultural and manufacturing sectors? In this section, this issue is explored for agriculture, over the period since the Green Revolution. The four major crops of the Punjab will be considered here, to illustrate dominant patterns of change. These major crops are wheat, paddy rice, cotton and sugar-cane. In 1966/67 these four crops took up 48% of the agricultural land area of the state, but this had risen to 81.2% by 1991/92 (Punjab Economic Adviser to the Government, Statistical Abstract of Punjab, annual). The cropped area for both wheat and paddy rice has increased from 36.6% of the agricultural land area of the state in 1966/67 to 70.5% in 1991/91, mainly due to the introduction of improved seeds which led to them yielding higher returns than other foodgrains (Gill, 1989; Bhalla, 1990; McGuirk and Mundlak, 1991). Most notable amongst the crops which saw their production areas fall for this reason were maize, bajra, and pulses. They saw their cropped areas decrease from 444,000, 184,000 and 692,000 hectares, respectively, in 1966/67, to 178,000, 9,000 and 116,000 hectares in 1991/92. In 1966/67 these three crops shared 25.5% of the total cropped area in the state, but this had fallen to 4.0% in 1991/92 (by contrast, paddy rice accounted for just 5.5% of the cropped area in 1966/67 but its share jumped to 27.5% in 1991/92).

Production trends in Punjab agriculture before the Green Revolution

Punjab is a relatively small state, accounting for just 1.65% of the Indian national land area and about 2.45% of its population. Yet, since 1970/71, Punjab has contributed about 60% of the foodgrains in the buffer stock of the national government's central pool, which is used for distributing foodgrains to other deficit states (Punjab Director of Agriculture, 1990). Indicative of the importance of agriculture in the state economy is the fact that, of a total geographical area of just over five million hectares, the total cropped area in the Punjab in 1966/67 was almost 5.2 million hectares (with 3.9 million hectares as the net area sown and 1.3 million hectares being sown more than once a year). This figure went up to 7.5 million hectares in 1991/92 (with 4.2 million hectares as the net area sown and 3.3 million hectares being sown more than once).

Historically, the Punjab region was among the first to develop a civilisation based on settled agriculture, which occurred under the Harappan or Indus Valley civilisation of the third millenium BC. Later, with the development of technology based on the use of iron implements and the cultivation of rice, the centre of North Indian civilisation moved to the lower Ganges Valley. Punjab continued to be an important region but no new thrust towards an urban civilisation emerged. It was almost entirely an agrarian society, with the basic instrument of production being the light wooden plough (Chaudhri and Dasgupta, 1985). As rainfall was scarce, cultivation was heavily dependent on irrigation, which was undertaken by water drawn from tanks, well and channels. However, for much of the region's history, when economic surpluses were generated these were extracted by the state in the form of land revenues and little was reinvested in public works. This pattern dominated farm activity in the state right up to the short period of Sikh rule from 1780-1839, which saw the introduction of a simplified land revenue system, a drastic curtailment in the powers of the Zamindar (landlords), and a reduction in the number of intermediaries between the direct producer and the state (Chaudhri and Dasgupta, 1985). The result of the Sikh system was to diminish the influence of local leaders. Under Sikh rule, the state dealt directly with each cultivator and land revenue was assessed not on land area but on production levels (Trevaskis, 1928). However, even during the Sikh regime, money-lenders still held their grip in the villages. Agricultural revenue was collected before the crop was cut, whether or not the crop was later damaged due to climatic misfortune. As a result, poor farmers were commonly forced to borrow money from money-lenders. As Darling (1947, p169) observed: '... in Punjab, there is ample evidence to show that, when the province was annexed [1849], the money lender was established all over the country. In central Punjab, as a result of the [ruling] sikhs collecting the revenue before the crop was cut, the zemidar was forced to borrow money from the bania [money-lender], who accommodated him at 25% per annum interest'.

In general, after British rule began in 1849, agriculture in the Punjab progressed. In particular, the hold of money-lenders in villages was eased when the Alienation of Land Act was passed in 1901 (see Rai, 1986). This bill also placed restrictions on the transfer of land from agricultural to non-agricultural classes. Another important change that occurred in land tenure arrangements was the 'privatisation' of land ownership. Before the British regime, land belonged to a whole village community, whereas the British encouraged individual property rights (Ali, 1988). Associated with this, farmers were encouraged to produce more food, and new road and rail transport facilities were developed. For the Province of Punjab, a new phase in agricultural development started under the British regime. But when partition came in 1947, the areas that had experienced the strongest advances went to Pakistan (Chaudhri and Dasgupta, 1985).

On account of the advantages of its physical environment, agriculture has long been assumed to dominate the economy of the greater Punjab. However, prior to 1947, what is the Indian Punjab of today was not particularly productive in agriculture. Thus, when Dasgupta (1981) compared crop output and acreage for what is now the Indian Punjab with its Pakistan equivalent, he concluded that production on the Indian side was stagnant over the 1906/7 to 1941/42 period. However, in anticipation of Independence, the building of the Bakra Dam gave a new development impetus to this area, as it significantly increased the potential for canal irrigation. Being supplemented by improvements in rural roads and electricity, through land consolidation schemes, by way of an expansion in village education, by more regulated agricultural markets and through increases in agricultural research, the post-independence period saw rapid rates of agrarian expansion. Available data for the pre-1966 Indian Punjab (which was essentially comprised of the present Punjab and Haryana, plus parts of today's Himachal Pradesh) indicates that during the period 1952 to 1964, there was an annual production growth rate of 4.6% in agricultural output, of which the area under crops increased at 1.9% per annum, so that yearly increases in yield were around 2.8% (Bhalla, 1990). This improvement in crop production was largely achieved by changing traditional cropping patterns in favour of more profitable crops, as well as by more extensive use of crop rotation.

Agriculture since the Green Revolution

The sharpest upward movement in the state's agricultural economy occurred as a result of the impact of seed-cum-fertilizer innovations that are popularly known as the Green Revolution. Reference to the Green Revolution is particularly pertinent here, for its arrival in the mid-1960s coincided with the formation of the new Punjab. The creation of the new Punjab in 1966 was a result of the national government's decision to base the Indian states on linguistic divisions (the old Punjab was split from a new state Haryana, with upland areas from the pre-1966 Punjab state being given to Himachal

Pradesh). The new state of Punjab has experienced very high rates of economic growth since the mid-1960s and the Green Revolution has had a great deal to do with this, due to the spectacular impact that new seed-fertilizer technology and high yielding crop varieties have had on agricultural productivity.

Of course, the credit for the large increases in productivity that occurred does not fall solely on the shoulders of these new technologies. Also deserving credit are the expansion and improvement of irrigation facilities, rises in fertilizer consumption, and improvements in farm mechanisation (Dantwala, 1970; Johl, 1975; Day and Singh, 1977; Gupta and Shangari, 1980; Chopra, 1982; Chadha, 1986; Kainth and Bawa, 1985; Sharma and Dak, 1989; Bhalla, 1990, McGuirk and Mundlak, 1991). The growing importance of irrigation is evident in the fact that the gross irrigated area in the Punjab expanded from 3.4 million hectares in 1966/67 to 7.1 million hectares in 1991/92. This meant that the percentage of the net sown area that was irrigated rose from 59.0% in 1966/67 to 93.0% in 1991/92. This irrigated area has not relied primarily on dam construction, for enhancement to the irrigated area have been made increasingly through tube-wells. Thus, the net area irrigated by tube-wells was 2.4 million hectares in 1991/92, whereas it was only 982,000 hectares in 1966/67, and the number of tube-wells increased from 200,000 in 1970/71 to 800,000 in 1991/92 (Punjab Economic Adviser to the Government, Statistical Abstract of Punjab, annual).

Along with the use of high yielding seed varieties and improved irrigation facilities, the increase in fertilizer consumption has been phenomenal in the Punjab. Thus, the consumption of chemical fertilizers increased from 51,000 nutrient tonnes in 1966/67 to 1.3 million tonnes in 1991/92. This growth would not have been possible without the efforts of the national government to increase fertilizer production (Pannu, 1992), yet the demand for fertilizer use also rose in part from the higher returns that resulted when they were used in combination with high yielding crop varieties. Hence, as with mechanisation, the Green Revolution did provoke the usage of other instruments that aided production rises, but Green Revolution technologies were not sufficient on their own to produce this effect. As for mechanisation, here the number of tractors and threshers increased from 41,000 and 134,000, respectively, in 1971/72, to 269,000 and 367,000 in 1989/90. What is more, the number of harvest combines rose from 570,000 in 1978/79 to 5.0 million in 1989/90 (Punjab Economic Adviser to the Government, Punjab Economy in Figures, annual).

The introduction of seed-fertilizer technology during the mid-1960s therefore brought about a marked quantitative change in farm production and led to unprecedented growth in agricultural output, particularly for wheat and paddy rice. In terms of the index for total agricultural production for the state (where 1969/70 equals 100), the Punjab saw an increase from 109.8 in 1970/71 to 270.3 in 1990/91. The index of productivity per hectare sown likewise increased from 113.04 in 1970/71 to 228.7 in 1990/91. Although less spectacularly, similar improvements were seen in indices for the net area sown, for cropping intensity, and for the area under crops (at 101.57 to 122.1, 100.64 to 131.2, and 102.17 to 145.3, respectively; Punjab Economic Adviser to the Government, Statistical Abstract of Punjab, annual). Moreover, indices for production for paddy rice have shown impressive increases from 1970/71 to 1990/91 (Table 4.4).

Most of this agricultural growth can be attributed to improvements in crop production which resulted from greater overall productivity and an increased cropped area for wheat and most particularly

Table 4.4

Index of Agricultural Production in the Punjab
(1969/70=100)

Period (July-June)	Paddy Rice	Wheat	Cotton	Sugar-cane	All Crops
1970/71	145.4	122.4	104.9	97.8	109.8
1971/72	194.4	133.7	123.0	74.8	118.9
1972/73	201.8	127.7	127.9	87.1	120.1
1973/74	240.9	123.3	141.3	108.1	128.3
1974/75	249.1	125.8	146.9	114.2	131.7
1975/76	305.8	137.7	151.5	113.8	144.8
1976/77	375.3	152.1	139.7	112.7	146.8
1977/78	527.6	158.0	152.0	121.1	164.1
1978/79	653.3	176.9	163.4	113.8	179.9
1979/80	644.9	187.2	149.2	72.8	167.0
1980/81	684.5	182.6	146.6	72.8	171.1
1981/82	794.0	203.3	158.2	111.6	190.3
1982/83	880.0	218.1	151.8	117.5	197.5
1983/84	960.5	224.1	88.0	102.6	192.7
1984/85	1,070.0	242.1	154.8	91.0	219.5
1985/86	1,162.3	261.4	174.7	93.7	236.0
1986/87	1,259.6	224.8	211.3	113.4	237.2
1987/88	1,152.2	263.7	233.2	108.1	244.0
1988/89	1,041.7	275.5	265.9	111.4	246.9
1989/90	1,417.3	277.5	307.4	120.7	281.3
1990/91	1,378.6	289.1	288.9	111.6	270.3

Source: Punjab Economic Adviser to the Government, Statistical Abstract of Punjab (annual).

paddy rice. These changes were produced by a shift to modern higher yielding crop varieties rather than as a result of intensifying cultivation using existing varieties of seed (McGuirk and Mundlak, 1991). Even so, there were significant changes in the type of crop grown. In 1966/67, for instance, the most important crops in the Punjab were wheat and pulses, for out of the total cropped area of 5.2 million hectares, 1.6 million and 692,000 hectares were occupied by wheat and pulses, respectively (by contrast wheat occupied 3.2 million, and pulses covered 116,000 hectares, out of the total cropped area of

7.5 million hectares in 1991/92). In 1966/67, paddy rice occupied just 285,000 hectares, but this figure rose to 2.1 million hectares in 1991/92. Today, paddy rice comes second only to wheat in its areal coverage. The area under cotton also increased during this period, although its growth was less spectacular (rising from 435,000 hectares to 697,000 hectares). As for sugar-cane, it stayed as the fourth most important crop in the state, even though its area sown declined from 156,000 hectares to 109,000 hectares over the 1966/67 to 1991/92 period (Punjab Economic Adviser to the Government, Statistical Abstract of Punjab, annual)

Yet since the mid-1960s, impressive production increases have been experienced for all four of these crops. Wheat production rose from 2.4 million metric tonnes in 1966/67 to 12.3 million metric tonnes in 1991/92, while paddy rice output grew from 338,000 metric tonnes to 6.7 million metric tonnes. Even though the area under sugar-cane decreased, its production rose from 436,000 metric tonnes in 1966/67 to 693,000 metric tonnes in 1991/92. A similar sharp production increase was recorded for the cotton crop, which saw an increase from 132,000 metric tonnes to 410,000 metric tonnes over this period (Punjab Economic Adviser to the Government, Statistical Abstract of Punjab, annual).

The primary factor that enhanced agricultural production was improvements in yield per unit area rather than an extension of the area under crops. Thus, in the 25 years between 1966/67 and 1991/92, unit area wheat yields in the Punjab grew by nearly 150% from 1,524 kilograms per hectare to 3,803 kilograms per hectare. Indeed, yield rates for wheat, paddy rice, sugar-cane and cotton have risen fairly consistently since the mid-1960s (Table 4.5). These increases gave a tremendous boost to the cultivation of paddy rice and wheat. Punjab is not a traditional rice cultivating state, as the crop has become widespread only since the arrival of high yielding crop varieties (Chopra, 1982; Bhalla, 1990). Wheat, on the other hand, has always been a major crop in this region, although it too saw its most rapid period of production expansion after the arrival of the Green Revolution (Chaudhri and Dasgupta, 1985; Chadha, 1986).

Table 4.5

Productivity Per Hectare for the Principal Crops of the Punjab (kilograms)

Period (July-June)	Paddy Rice	Wheat	Cotton	Sugar-cane
1966/67	1,185	1,524	562	2,804
1967/68	1,322	1,863	648	3,507
1968/69	1,364	2,177	685	3,289
1969/70	1,490	2,245	702	4,146
1970/71	1,765	2,238	737	4,117
1971/72	2,045	2,406	733	3,912
1972/73	2,007	2,233	729	4,602
1973/74	2,287	2,216	733	5,289
1974/75	2,071	2,395	717	4,997
1975/76	2,553	2,373	696	5,374
1976/77	2,611	2,430	661	5,371
1977/78	2,910	2,539	656	5,612
1978/79	2,937	2,716	650	5,668
1979/80	2,604	2,798	598	5,099
1980/81	2,736	2,730	568	5,526
1981/82	2,957	2,932	580	5,779
1982/83	3,144	3,004	490	6,098
1983/84	3,063	3,015	329	6,580
1984/85	3,073	3,289	758	6,230
1985/86	3,200	3,531	742	6,468
1986/87	3,331	2,966	859	6,300
1987/88	3,164	3,540	828	5,487
1988/89	2,770	3,667	758	6,186
1989/90	3,510	3,593	945	6,312
1990/91	3,229	3,715	766	5,941
1991/92	3,257	3,803	970	6,348

Source: Punjab Economic Adviser to the Government, Statistical Abstract of Punjab (annual).

Promoting Agricultural Expansion in the Punjab

What should be noted is that agricultural improvement in the Punjab has not resulted from a 'natural' (free-market) economic situation. Underwriting production changes were significant governmental decisions. These were seen in the encouragement given by the national government to the introduction of Green Revolution technologies, as well as to the provision of support facilities that would enhance the benefits from such technologies (like increased fertilizer production and more farm machinery output). Governmental intervention was also critical to the provision of infrastructure that enabled better usage of existing land resources (such as improvements in irrigation and in transport facilities). In addition, agrarian change was assisted through changes in marketing arrangements and in institutions supporting the farm sector.

<u>Agricultural Marketing Structure of the Punjab</u> One of the major ways in which agricultural growth in the Punjab has been promoted is through investment in new market facilities. Investment in improved market infrastructure was undertaken in response to the higher production brought on by the Green Revolution, in order to help farmers sell their produce more readily, as well as to give them sufficient incentive to invest in new technology (Bhalla, 1990). As Mellor (1968) stressed some time ago, each of commodity prices, inter-sectoral income distribution and capital formation are all affected by the framework of the marketing system. As such, a proper understanding of the marketing distribution process is important, for any change in this process could have a considerable impact on the development of the agricultural

sector, not simply through its effect on the allocation of resources within the agricultural sector but also for the balance of resource utilisation between agriculture and the rest of the economy (Lele, 1971).

In the Punjab almost all of the (marketable) farm produce has to pass through government regulated agricultural markets (Lele, 1971). Perhaps not surprisingly, given the magnitude of farm production growth, this has led to the number of regulated markets in the state increasing from 88 in 1967 to 143 in 1992. This increase has meant that the average area served by each regulated market has decreased from 573 square kilometres in 1967 to 352 square kilometres in 1992 (Punjab Economic Adviser to the Government, Statistical Abstract of Punjab, annual). Along with the Food Corporation of India, the Punjab State Agricultural Marketing Board is required to purchase the entire market arrival of foodgrains that is offered to it (at a fixed support price, which is suggested by the Government of India but determined by state governments).

The nature of the sale process is that an open auction is held for wheat and paddy rice in the regulated markets. Private traders and even manufacturers (who have a trading licence) can enter into this open auction. But the maximum auction price is fixed by the state government (nobody can offer more than the maximum fixed price). These restrictions are intended to avoid the unnecessary private storage of farm produce, so that buyers should require the produce they purchase for immediate use and do not buy commodities for speculative reasons (Bibra, 1993). It is important to note that, while private traders can participate in the open auction, for farmers in the Punjab there are subsidies if they sell their produce to government agencies (in the form of an extra bonus price, which is higher than the support price). These government procured foodgrains are used to build up buffer stocks for export to deficit producer states. As a result, private traders find it difficult to export farm produce to the other states of India. Other than traders, manufacturers' purchases also function under national and state government direction. For the wheat crop, a maximum quantity of foodgrain purchases is fixed for every manufacturer (they can not buy more than this fixed amount, either for storage or in order to increase their manufacturing capacity, without applying to the state government for the authority to do so). It is not surprising, therefore, to find that Gill (1988) concluded that almost 95% of wheat market arrivals in the Punjab are procured by government agencies.

Unlike wheat, government procurement of paddy rice is not dominated by purchases made from regulated markets. More commonly, it is procured through a levy on rice millers, after they have processed the paddy rice into rice. This procedure is used because rice in husk (paddy rice) is much heavier than shelled rice, so the national government is prepared to accept local processing of rice husk to reduce transport costs during 'exportation'. According to the Punjab Rice Procurement Levy Act, 1958 (amended as the Punjab Rice Procurement Levy Order; Punjab Department of Food and Supplies, 1983), manufacturers or dealers (with a licence) must purchase paddy rice directly from regulated markets, and they are required to deliver a fixed share of this paddy rice (after processing) to the government. This results in a major proportion of paddy rice in the regulated markets (almost 80% of total market arrivals) being purchased by rice millers and not by government agencies (Rangi, 1989). By contrast, the cotton crop is procured by the Cotton Corporation of India (as the dominant buyer in the state) directly from regulated markets (Patnaik, 1990). The Corporation undertakes 'support price' purchases and also 'commercial purchases' (higher prices than the support price), to meet the requirements of the textile mills of the National Textile Corporation, as well as for national buffer stocks. For sugar-cane, the marketing of farm produce is not undertaken through the state's regulated markets. The cultivation of commercial sugar-cane is mainly confined to the catchment areas of sugar mills and most farm produce is bought directly from farmers by these mills (Singh, 1990). Here sugar-cane catchment areas are allotted to each sugar mill by a government appointed Cane Commissioner, with collection centres established every 20 kilometres around the sugar mill for the farmers' convenience (Kanwal, 1985).

Agricultural Institutions in the Punjab In addition to support offered through the marketing system, a variety of institutions exist within the state that have been established with the explicit aim of assisting agricultural improvements. For Randhawa (1974), cheap finance and credit (supplied by various agricultural institutions) was one of the important factors behind the success of the Green Revolution in the Punjab. Likewise, Nicholson (1984) has argued that co-operative institutions have played a key role in the state government's programme for encouraging the adoption of new technologies (as well as in supplying fertilizer, credit, and promoting packages of new farm practices and the utilisation of new seeds), with Nicholson also making the case that rural co-operatives were highly equitable in delivering production credit to smaller farmers. In fact, all these facilities are promoted by the state government through the policy directions it gives to extension agencies. The ready availability of co-operative credit for fertilizer purchase, the convenient availability of fertilizer supplies through a wide network of sales points (Chaudhri and Dasgupta, 1985; Chadha, 1986), marketing co-operatives and the Land Mortgage Bank, the last of which provides long-term loans for tractors and tube-wells (Leaf, 1987), are all important factors in the rapid agricultural growth that the state has seen.

However, the phenomenal increase in production has also been made possible by the strong working linkages that exist between extension agencies (e.g. the Punjab Agricultural University, the Punjab Department of Agriculture, and Punjab Registrar for Co-operatives Societies). These agencies provide farmers with the latest technical know-how, as well as supplying inputs like fertilizers, insecticides, pesticides and weedicides. At the local level, Block Agricultural Officers were appointed by the Department of Agriculture in order to give guidance to local farmers (with training camps arranged for farmers to get expert advice), while a seed testing laboratory was provided for the use of farmers, with the quality of fertilizer/pesticides having been constantly kept under check. As new high-yielding varieties of cereal crops have the potential to yield two to three times more than that of the varieties available in the early 1960s, the systematic efforts made by the plant breeders of the Punjab Agricultural University have also had an important part to play (Gill, 1989). So did the agricultural credit co-operative societies, which constituted the major source of finance for farmers (with 17 Central Co-operative Banks and 4,633 branches of agricultural co-operative societies in 1990/91; Punjab Economic Adviser to the Government, Statistical Abstract of Punjab, annual). In essence, after 1966/67, the Department of Agriculture offered a package of practices to the farmer in which the co-operative societies were responsible for providing loans, fertilizers, pump sets, seeds and pesticides (Gill, 1985).

However, despite all the assistance that has been provided, the farmers themselves must be credited a great deal, owing to their willingness to tackle new opportunities. For example, even for an expensive item like a tractor, a survey from 1981/82 to 1983/84 found that farmers used their own funds for 34.0% of the cost of purchase, with a further 41.0% coming from commercial banks and only 25.0% being financed by the state supported Land Mortgage Banks (Punjab Economic and Statistical Organisation, 1987). This compares with figures for the period 1969/72, when a 32.0% share of the cost of tractors came from the farmers' own funds, with 9.0% from commercial banks and 59.0% from state aided co-operative bank assistance (Punjab Economic and Statistical Organisation, 1973). Likewise, while irrigation development has received strong support from state government programmes, as well as from loans from co-operative societies, a Punjab Economic and Statistical Organisation survey in 1979 estimated that 74.0% of cultivators used their own financial resources to acquire tube-wells and pump sets, with only 10.0% drawing on co-operative institutions for assistance and just 16.0% of funds being provided by any of state or national government loans, commercial bank loans, money-lenders, or friends and relatives (Punjab Economic and Statistical Organisation Punjab, 1981). Similar indications of self-reliance are found in another survey by the Punjab Economic and Statistical Organisation, which evaluated the role of marketing societies over the 1967/68 to 1976/77 period. Here it was found that 89.0% of the managers of sampled societies reported that their societies had never supplied seeds to farmers, with 93.0% indicating that they had never supplied agricultural implements (Punjab Economic and Statistical Organisation, 1979).

From this and the previous sections, we can see that growth in farm output has owed much to farmer initiative, but that this initiative has been encouraged and supported by marketing, input supply and infrastructural provision arrangements, through which the state and national governments have been highly influential. If we are to understand the prospects for manufacturing growth in the state, we need to appreciate the support structures for this sector. This is the task we now turn to.

Manufacturing Growth in the Punjab

Despite limitations imposed through the partition of Pakistan (and then by proximity to the Pakistan border), Bhalla and associates (1990) have argued that close links with the rest of the national economy have enabled the Punjab to derive a great deal of comparative advantage through economic specialisation, not simply for farm crops but also in some manufacturing lines. However, the low priority for the state in national government manufacturing investment has to be seen as a factor which helps account for weak industrialisation within the state (Singh, 1987). Priority has been given to agricultural production and the improvement in irrigation and power capacities, which has imposed severe limitations on state resources for other economic endeavours (Nair, 1992). Even in the Industrial Policy of Punjab of 1987 (other than national government policies, the state government can introduce their own industrial policies, including offering of extra incentives to manufacturers), it was pointed out that national government incentives are mainly inclined towards backward areas of the country, which places the Punjab in a disadvantageous position. However, this is not the whole story, for communal conflict between Hindus and Sikhs has also been credited with causing backwardness in Punjab manufacturing (Mehta and Mehta, 1990). One aspect of this, as Rai (1988) identified, is that the commercial bourgeoisie in the state, from money-lenders to industrialists, are mostly Hindus. In fact, even before the British, the Hindus were the dominant class in rural areas. However, the Alienation of Land Act of 1901 had an important bearing on rural society, as it divided the population into agricultural and non-agricultural tribes. As a consequence, those money-lenders who were Hindu were unable to take over agricultural land if farmers defaulted on loans. This encouraged a large number of money-lenders to move to the towns, which meant that town and country became more socially separated. At the time of the Green Revolution, Jat Sikh landlords held the dominant economic positions in the agricultural sector, whereas industry and commerce were mainly controlled by the Hindu upper classes (Rai, 1986). One consequence of this division is that farmers are held to lack entrepreneurial strength in non-farm activities, as they do not have the necessary expertise and experience of non-farm business life and there is stiff competition from established businesses and industrialists. Hence, farmers still invest much of their surplus income outside manufacturing, particularly in transport, cinemas, and cold storage facilities, as well as in consumer items like the purchase of jeeps and cars, social ceremonies, etc. (Johal, 1975; Bhalla and Chadha, 1983; Bansal, 1985; Gill, 1987; Gill, 1988; Sharma, 1988).

Leaving these suggested reasons for the relatively weak manufacturing base of the Punjab to one side, there is no doubt that the Green Revolution changed traditional agricultural practices, so farmers came to depend increasingly on input supplies from manufacturing, like fertilizer and farm machinery (Ghosh, 1977; Pollard 1983; Chaudhri and Dasgupta, 1985; Chadha, 1986; Singh, 1987; Sharma, 1988; Bhalla, 1990). So, despite the fact that manufacturing is said to be relatively weak, the share that this sector has taken of the Punjab workforce has increased over time, from 11.1% in 1977/78 to 15.1% in 1987/88 (Table 4.6).

Table 4.6

The Distribution of the Punjab Workforce by Economic Sector (percentage)

Sector	1977/78	1983/84	1987/88
Agriculture	62.2	56.8	50.1
Manufacturing	11.1	12.1	15.1
Electricity	0.6	1.3	1.1
Construction	2.8	3.8	3.8
Trade	8.1	8.4	10.1
Transport	3.1	5.3	5.0
Other Services	12.0	12.3	14.1
Other	0.0	0.0	0.6

Source: Sarvekshana (1981, 1987, 1990).

When assessing manufacturing growth in the state, it is pertinent to pay attention to different classes of manufacturing plant: (a) the registered working factories (only include those plants which employ ten or more workers if the factory uses electric power in its production process or units that employ 20 or more workers if they do not use electric power), (b) small-scale manufacturing units, and (c) medium/large-scale plants (for a definition of small-scale and medium/large-scale manufacturing sectors see pages 78-83). Analysis shows that since the mid-1960s the registered manufacturing sector of the Punjab has grown substantially (Table 4.7). The number of registered factories increased by 230.3% from 1966/67 to 1991/92, and employment during this period grew by 270.3%. The small-scale manufacturing sector has also expanded remarkably; in terms of the number of working units, the value of production, and total employment. Hence the number of units grew by more than five-fold from 1974/75 to 1991/92, with the same period seeing a three-fold increase in the number of employees (Table 4.8).

Table 4.7

Registered Working Factories in the Punjab

Period (July-June)	Number	Employment
1966/67	3,544	103,654
1967/68	3,674	105,993
1968/69	3,940	104,307
1969/70	4,141	105,924
1970/71	4,501	116,806
1971/72	4,553	118,503
1972/73	4,817	118,657
1973/74	4,933	127,451
1974/75	5,110	131,100
1975/76	5,279	136,280
1976/77	5,415	144,359
1977/78	5,758	156,817
1978/79	6,008	168,072
1979/80	6,624	188,098
1980/81	7,053	201,735
1981/82	7,315	208,732
1982/83	8,178	239,191
1983/84	8,535	243,008
1984/85	9,184	273,932
1985/86	9,271	282,214
1986/87	9,754	298,503
1987/88	10,255	326,722
1988/89	10,419	336,050
1989/90	10,734	345,145
1990/91	11,396	367,513
1991/92	11,705	383,798

Source: Punjab Economic Adviser to the Government, Statistical Abstract of Punjab (annual).

Production growth was less spectacular for medium/large scale manufacturing plants (in terms of the number of units, production, and employment), yet the growth that has been recorded has still been impressive. Thus, the number of medium/large-scale production units rose from 63 in 1966/67 to 395 in 1991/92, with employment increasing more than three-fold, and the value of production rising from 734.8 million rupees in 1974/75 to 84,000.0 million rupees in 1991/92 (Table 4.9).

Table 4.8

Small-Scale Manufacturing in the Punjab

Period (July-June)	Units (number)	Production (rupees million)	Employment (number)
1974/75	32,938	4,765.4	249,939
1975/76	34,776	5,386.6	254,456
1976/77	36,737	5,689.5	262,776
1977/78	38,652	6,585.9	275,727
1978/79	42,233	7,512.6	298,925
1979/80	47,437	8,881.9	333,090
1980/81	53,338	11,184.4	364,869
1981/82	65,445	13,038.0	416,310
1982/83	76,947	14,500.0	424,310
1983/84	76,588	17,860.7	428,846
1984/85	88,271	19,579.2	444,478
1985/86	97,517	21,509.9	464,809
1986/87	108,913	23,586.3	503,397
1987/88	119,888	26,815.3	545,560
1988/89	132,000	29,950.0	586,048
1989/90	146,443	35,041.0	633,964
1990/91	160,368	40,498.2	668,845
1991/92	175,350	44,750.0	720,000

Note: Data are not available for the total output of small-scale manufacturing plants until 1974/75.

Source: Punjab Economic Adviser to the Government (1990) and unpublished files at the Punjab Directorate of Industries.

Whether in large/medium-scale or small-scale units, the index of manufacturing production (for which data are only available from 1975/76 onwards, excluding 1976/77 and 1977/78) gives a further indication of manufacturing expansion in the state. Since 1975/76 total manufacturing production in the Punjab has increased to such an extent that the general index for manufacturing production had risen by 341.6% (from 1975/76 to 1990/91). Perhaps not unexpectedly, this growth was uneven across manufacturing sectors. In particular, industrial groups relating to paper products, nonmetallic mineral products, and rubber products showed impressive increases in production (Table 4.10), at levels which are much higher than the average index of growth in manufacturing production in the state. Of these sectors, only paper products has any direct link with agriculture, owing to changes in production practices that have seen increased usage of rice and wheat straw in paper manufacture. However, there was also strength in the growth performance of electrical machinery and transport equipment production, which both derive important sales from the farm sector (Table 4.11). Significantly, however, despite high levels of farm production growth, sectors like food products, beverages and textiles experienced lower growth levels than the state average (Table 4.12).

Table 4.9

Medium/Large-Scale Manufacturing in the Punjab

Period (July-June)	Units (number)	Production (rupees million)	Employment (number)
1966/67	63	734.8	42,735
1970/71	94	1,594.0	46,403
1971/72	91	1,675.1	45,095
1972/73	105	2,187.3	50,960
1974/75	132	3,080.0	57,891
1975/76	144	3,849.1	63,291
1976/77	160	4,712.2	69,942
1977/78	175	6,074.9	77,071
1978/79	188	7,108.5	91,551
1979/80	203	9,459.9	98,876
1980/81	228	11,410.7	109,767
1981/82	253	12,038.2	111,946
1982/83	270	14,780.0	115,695
1983/84	267	19,926.8	124,819
1984/85	273	20,714.3	131,381
1985/86	292	25,350.0	132,000
1986/87	306	31,847.3	142,381
1987/88	322	37,775.3	151,199
1988/89	340	43,505.3	155,699
1989/90	355	54,581.5	169,801
1990/91	373	71,636.9	187,311
1991/92	395	84,000.0	196,000

Source: Punjab Economic Adviser to the Government (1990) and unpublished files at the Punjab Directorate of Industries.

Table 4.10

Index of Manufacturing Production in the Punjab
(Base 1975/76=100)

Period	Paper Products	Leather Products	Rubber Products*
1976/77	107.1	117.4	104.0
1979/80	135.2	199.2	166.5
1980/81	156.4	246.7	188.2
1981/82	196.3	289.1	221.9
1982/83	108.2	280.3	245.9
1983/84	1,240.2	74.4	308.0
1984/85	1,326.4	296.9	335.2
1985/86	1,347.1	791.0	276.6
1986/87	1,526.1	319.5	329.2
1987/88	1,852.7	230.1	366.9
1988/89	2,688.2	390.0	461.9
1989/90	3,278.4	423.4	546.4
1990/91	3,646.5	286.1	548.6

* including plastic, petroleum and coal products.

Index of Manufacturing Production in the Punjab
(Base 1975/76=100)

Period	Chemical Products	Mineral Products*	Basic Metal
1976/77	97.4	137.4	103.8
1979/80	158.3	156.7	168.6
1980/81	185.1	161.7	192.4
1981/82	206.9	164.9	200.4
1982/83	142.6	538.2	311.6
1983/84	187.3	500.1	232.8
1984/85	164.6	540.1	224.3
1985/86	163.0	484.9	217.1
1986/87	204.1	979.8	255.1
1987/88	246.0	1,171.9	262.7
1988/89	288.6	1,385.5	245.1
1989/90	300.6	941.4	229.7
1990/91	378.4	831.8	267.5

* non metallic
Note: No data were available for 1977/78 and 1978/79

Source: Punjab Economic Adviser to the Government, Statistical Abstract of Punjab (annual).

Table 4.11

Index of Manufacturing Production in the Punjab
(Base 1975/76=100)

Period	Metal Products*	Machinery**	Electrical Machinery
1976/77	138.2	139.1	114.2
1979/80	158.3	300.4	178.5
1980/81	174.3	326.4	225.7
1981/82	199.4	320.2	191.5
1982/83	231.0	293.5	222.7
1983/84	159.6	233.1	205.6
1984/85	186.3	250.4	173.0
1985/86	209.3	224.6	170.3
1986/87	187.7	288.1	211.4
1987/88	155.8	278.9	300.5
1988/89	170.8	258.5	382.0
1989/90	407.4	367.9	368.3
1990/91	389.4	301.9	463.1

* except machinery and transport equipment,
** including machine tools and parts except electrical machinery

Index of Manufacturing Production in the Punjab
(Base 1975/76=100)

Period	Transport Equipment	Others
1976/77	110.6	142.3
1979/80	173.1	151.0
1980/81	164.0	191.0
1981/82	184.3	218.9
1982/83	173.2	218.7
1983/84	276.7	175.6
1984/85	275.9	188.0
1985/86	283.3	218.2
1986/87	285.8	230.4
1987/88	262.0	219.3
1988/89	370.6	172.5
1989/90	370.8	222.0
1990/91	418.5	233.1

Note: No data were available for 1977/78 and 1978/79

Source: Punjab Economic Adviser to the Government, Statistical Abstract of Punjab (annual).

Table 4.12

Index of Manufacturing Production in the Punjab
(Base 1975/76=100)

Period	Food Products	Beverages*	Cotton Textiles
1976/77	100.5	132.8	78.9
1979/80	144.0	103.3	96.1
1980/81	135.4	102.7	100.9
1981/82	161.5	98.8	124.5
1982/83	191.0	110.1	137.0
1983/84	188.2	166.3	137.3
1984/85	200.0	98.6	117.5
1985/86	233.1	238.8	120.7
1986/87	240.7	187.8	137.2
1987/88	260.5	191.4	140.0
1988/89	305.0	262.1	149.1
1989/90	293.9	277.4	167.2
1990/91	262.4	295.9	183.1

* including tobacco and tobacco products

Index of Manufacturing Production in the Punjab
(Base 1975/76=100)

Period	Wool Textiles*	Textile Products	Wood Products
1976/77	118.3	103.6	106.5
1979/80	152.7	119.9	190.6
1980/81	174.2	168.9	226.2
1981/82	168.8	191.2	187.2
1982/83	177.0	173.5	80.9
1983/84	154.9	118.6	312.4
1984/85	152.0	265.3	83.9
1985/86	180.1	188.0	61.3
1986/87	168.2	203.7	86.6
1987/88	176.4	166.4	67.7
1988/89	200.5	159.4	66.5
1989/90	214.1	180.0	46.7
1990/91	239.5	210.6	68.1

* including silk and synthetic fibre.
Note: No data were available for 1977/78 and 1978/79

Source: Punjab Economic Adviser to the Government, Statistical Abstract of Punjab (annual).

Promoting Manufacturing Expansion

The substantial manufacturing growth that has occurred should not be separated from the general efforts of the state and national governments to encourage expansion in this sector. As Bhalla (1990) argued, the state's industrial policy is clearly part and parcel of economic policy at the national level. This is particularly true with regard to licences, tariffs, customs duties, export and import duties, as well as export subsidies, with the state of Punjab also making use of many of the promotional programmes undertaken by the national government.

Yet, in terms of locational and production decisions, the integration of state and national policy is most evident for medium/large-scale factories. In the Punjab, it is the Punjab State Industrial Development Corporation and the Punjab Financial Corporation that promotes projects in the medium/large-scale manufacturing sector, as well as acting as the agents that extend loans under the refinance scheme of the Industrial Development Bank of India (although the Punjab Financial Corporation also promotes small-scale manufacturing). The Punjab Financial Corporation also disburses central government subsidies for setting up projects in centrally designated districts of the Punjab, as well as enhancing the scope of foreign investment in the development of the state economy. But its ability to provide share capital and to make loans for industrial projects is also important, for, as Bansal (1985) has argued, commercial banks in the state do not appear to have been playing their due role in its industrial growth.

Irrespective of the scale of the enterprise, it is pertinent to note that agro-based industries receive particular attention from the state government. This was formalised by setting up the Punjab Agro Industries Corporation in 1966. The entire share capital of this Corporation is held by the Government of Punjab and the Government of India. This is a premier organisation of the state government, which is charged with assisting (financially or otherwise) and stimulating agro-based industries, providing agricultural inputs like fertilizer, pesticides and the renting of farm machinery to farmers, as well as promoting the processing of horticultural and food crops. The Agro Industries Corporation has also established a few factories in cooperation with foreign multinational companies (the most notable example of which is an integrated food and beverages project set up in financial collaboration with Pepsico of the USA).

<u>Encouraging Small-Scale Manufacturing</u> It is important to recognise that smaller scale manufacturing enterprises, which are more readily responsive to prompts from agrarian expansion or other input and market opportunities, are also given significant encouragement by government policies. The National Small Industries Corporation, for instance, which is a Government of India enterprise, has provided active and continued assistance to small-scale manufacturing in the state. The units assisted by this Corporation are engaged in a variety of manufacturing activities, including machine tools, foundries, bicycles and bicycle parts, hosiery, sewing machines, sports goods and automobile parts. At the state level, the Directorate of Industries and the Small Scale Industries Development Corporation are key institutions, with the Punjab Small Scale Industries and Export Corporation also promoting market expansion for small-scale manufacturing in the state (including the marketing and promotion of the state's handicrafts through its emporium and the coordination of export efforts; Juneja, 1990). Most deeply involved with

smaller production units is the Punjab State Small Scale Industries Corporation. This came into existence in 1962 to supply machines on hire purchase, to develop and allocate industrial sheds and to assist in the marketing of manufactured goods. It took on the job of procuring and distributing scarce raw materials (e.g. iron and steel), at controlled prices, through depots established (mainly) at its district headquarters. This focused orientation in the administrative arrangements of this organisation was strengthened by the national industrial policy statement of 1977, in which the concept of the District Industries Centre was presented as a focal point for decentralised industrial growth throughout the country (in each district of every state). This initiative was especially aimed toward developing small-scale manufacturing. Units which are not registered with the District Industrial Centre do not benefit from the full impact of benefits from government policies.

Although the development of small-scale manufacturing is the responsibility of the state government, the national government has played an active role in their promotion. The basic policy for small-scale manufacturing was formulated at the national level, but its implementation is the responsibility of the state government. A Small Scale Industries Board was set up in 1954, charged with advising the national government on the planning and coordination of a programme for the development of small-scale industries. Not surprisingly, accompanying the various special attentions that are bestowed on small factory units are special funds and resource allocations. Thus, the Punjab Directorate of Industries provides financial assistance through the District Industries Centres to household manufacturing with an investment of less than 200,000 rupees, provided they are located in villages or towns with a population of under 100,000 persons (Punjab Udyog Sahayak, 1990).

This government promotion largely enables entrepreneurs to improve their manufacturing performance or helps them start new enterprises. However, if agriculture has really spurred growth in manufacturing investment, this should be evident in spontaneous reactions to the opportunities offered by agrarian expansion, especially for small-scale enterprises (Bhalla, 1990). Government assistance does ease this path, so entrepreneurs are encouraged to take up these opportunities, but it does not determine that they do so (in the Punjab, the state government began its efforts to promote small-scale manufacturing only in the late-1970s, after the establishment of the 'District Industries Centres' policy of the national government). What we turn to in the final section of this chapter is consideration of whether temporal patterns of production in agriculture and allied manufacturing do suggest that manufacturers have responded to the prompts of agrarian growth or whether expansion in their activities appears to be little related to that growth.

Linkages between Agriculture and Agro-based Manufacturing

A substantial amount of empirical evidence is available which permits clarification of the impact of the Green Revolution on foodgrain output in the Punjab (Bhalla et al, 1990; McGuirk and Mundlak, 1991). Aggregate evidence suggests that this agricultural growth has had a general impact on manufacturing by raising gross and per capita state income. Of course, if we wish to trace this effect across different manufacturing sectors, this would require an input-output analysis. Such an exercise was beyond the resources available for this study. Besides which, the static picture that input-output tables provide does not give a real sense of the dynamism of linkages between agriculture and manufacturing (even if comparison is made between two time-points, only a rough approximation for trends can be made, as the necessary assumption is one of linear progression between years, when the real relationship could be more complex and changeable). Consequently, efforts are made here to see if a simultaneous growth pattern occurred in agricultural development and agro-based manufacturing within the state.

To achieve this, we can use indices of manufacturing and agricultural production. For manufacturing, this shows that output growth has occurred in every sector, but that sectors with the strongest links to farming (food products, beverages, textiles etc.) grew by less than the state average (Table 4.12). It is true that some of the faster growing sectors (like electrical machinery and transport equipment) are somewhat related to input provisions for the agricultural sector (Table 4.11), and the paper products sector has experienced the fastest growth of any manufacturing class (Table 4.10). However, paper factories are not only dependent on agricultural residues for their input supplies, as many other types of raw material are used in these factories (grass, waste paper etc.; unpublished files at the Punjab Directorate of Industries, 1990). It is likely then that even paper manufacturing has not expanded primarily due to its direct links with agricultural output growth. In fact, in the main it was manufacturing sectors with low direct linkages to farming that grew the fastest, with sectors more closely bound to the farming sector having more modest growth rates. Despite this, analysis of the temporal coincidence of growth in agricultural production and changes in the number of agro-based manufacturing plants does provide a preliminary

Table 4.13

Date Operation Started for Medium/Large-Scale Agro-based Manufacturing Plants in the Punjab in 1992 (number)

Sector	1966 or earlier	1967-79	1980 or later
Rice Bran processing		7	27
Wheat processing	6	2	3
Cotton processing	5	8	13
Sugar-cane mills	5	1	11
Agricultural Machinery	3	1	1
Fertilizers and Pesticides	1	3	4
Total	20	22	59

Source: unpublished files at the Punjab Directorate of Industries.

indication of the existence of growth linkages between agriculture and agro-based manufacturing. For instance, the total number of medium/large-scale agro-based manufacturing plants in the state did increase from 20 in 1966 to 59 in 1990 (Table 4.13).

For manufacturing sectors that rely on wheat inputs, like flour and bakery products, production in medium/large-scale manufacturing plants increased from 66.0 million rupees in 1966/67 to 483.8 million rupees in 1989/90 (for small-scale manufacturing these increases were 10.8 million rupees in 1979/80 and 92.9 million rupees in 1989/90). However, despite this growth, the production share of flour mill and bakery plants in the total value of medium/large-scale manufacturing output in the state decreased during the 25 years that followed the start of the Green Revolution. For instance, in 1966/67, plants in these manufacturing sectors contributed 9.0% of medium/large-scale plant output, but by 1989/90 its share had fallen to 0.9% (Table 4.14).

Table 4.14

Production Trends in Medium/Large-Scale Flour Mills and Bakery Products Manufacturing in the Punjab (million of rupees)

Period	Production	% share
1966/67	66.0	9.0
1970/71	127.9	8.0
1971/72	121.3	7.2
1972/73	147.6	6.7
1973/74	161.1	5.7
1974/75	191.4	6.2
1975/76	187.6	4.9
1976/77	211.1	4.5
1977/78	219.2	3.6
1978/79	246.6	3.5
1979/80	316.5	3.3
1980/81	338.7	3.0
1981/82	392.7	3.3
1982/83	503.5	3.4
1983/84	436.6	2.2
1984/85	392.1	2.0
1985/86	374.4	1.5
1986/87	373.0	1.2
1987/88	415.7	1.1
1988/89	437.0	1.0
1989/90	483.8	0.9

Note: Share refers to the percentage of total production by value in medium/large-scale manufacturing plants

Source: unpublished files at the Punjab Directorate of Industries.

On the other side, the volume share of farm wheat production to total crop output rose from 47.2% in 1966/67 to 57.4% in 1991/92 (for wheat production has increased from 2.4 million metric tonnes in 1966/67 to 12.3 million metric tonnes in 1991/92; Punjab Economic Adviser to the Government, Statistical Abstract of Punjab, annual). Hence, although wheat production has increased substantially since 1966/67, the production share of its associated agro-processing sectors of flour milling, baking and biscuit production has not only declined for medium/large-scale plants but has also fallen for small-scale manufacturing from a 1.2% production share to a 0.3%

share over the 1980s (Table 4.15). Allied to this, since 1966/67, output growth rates have been very much slower in flour mill and bakery plants than increases in farm produce (Figure 4.1). Thus, the value of farm produced wheat has increased from 1,534.3 million rupees in 1966/67 to 22,468.7 million rupees in 1989/90, but the production increase in medium/large-scale flour mill and bakery plants has only risen from 66.0 million rupees in 1966/67 to 483.8 million rupees in 1989/90.

Table 4.15

Production Trends in Small-Scale Bread, Biscuit and Confectionery Manufacturing in the Punjab (million of rupees)

Period	Production	% share
1979/80	10.8	1.2
1980/81	16.1	0.1
1981/82	21.6	0.2
1982/83	30.3	0.2
1983/84	39.6	0.2
1984/85	51.1	0.3
1985/86	57.0	0.3
1986/87	56.1	0.2
1987/88	74.3	0.3
1988/89	86.6	0.3
1989/90	92.9	0.3

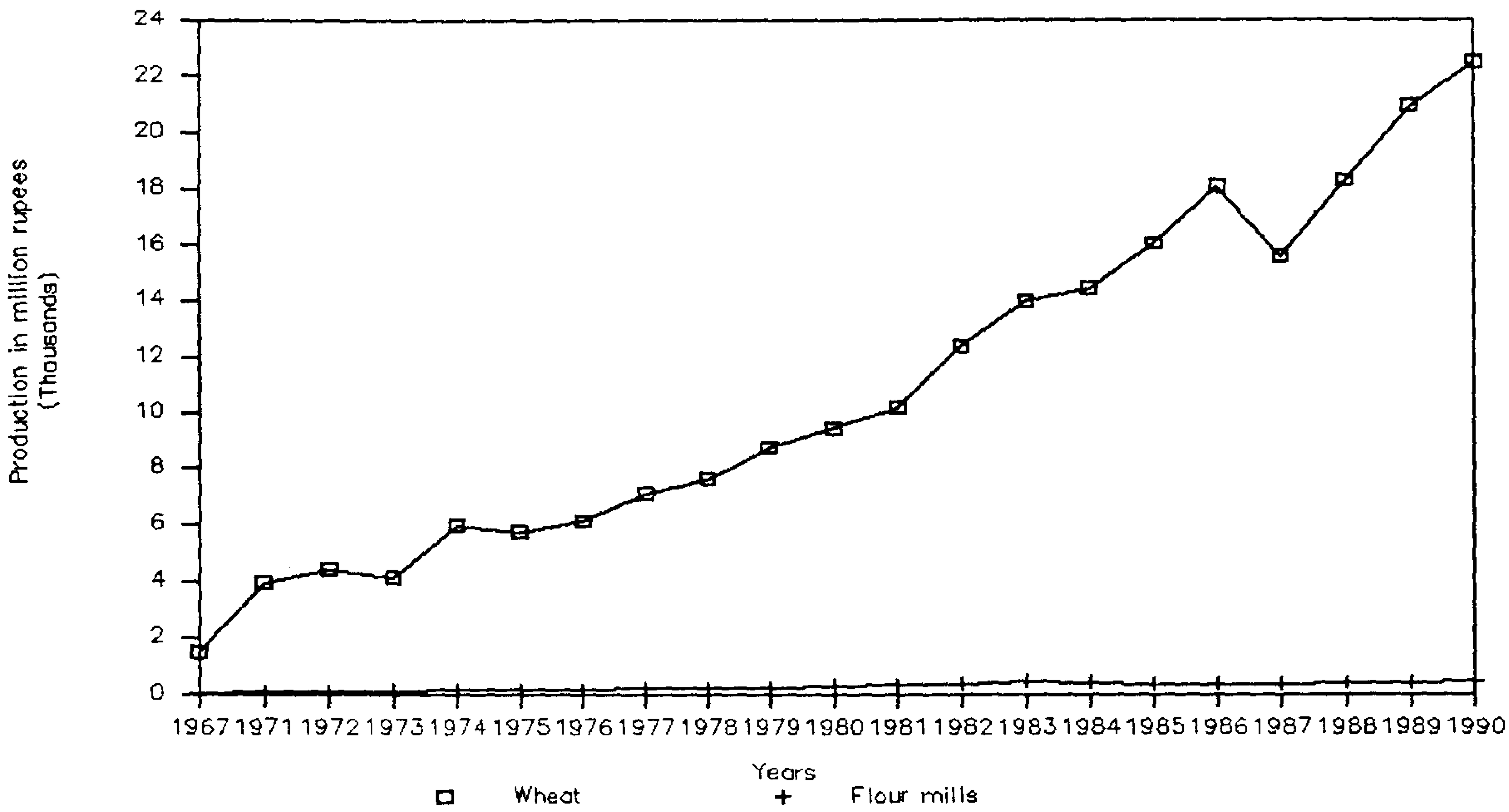
Note: Share refers to the percentage of total production by value in small-scale manufacturing plants

Source: unpublished files at the Punjab Directorate of Industries.

Viewed in this light, it is perhaps no surprise that a recent estimate of the proportion of Punjabi wheat that is processed within the state puts the figure at only 2.5% (Patnaik, 1990). This point is emphasised when we note that estimates of the Punjabi exports of unprocessed wheat are much higher than for wheat flour, with unprocessed wheat exports having doubled since the Green Revolution, whereas wheat flour exports have hardly changed (Table 4.16).

Figure 4.1

Production of Wheat, and Flour Mills and Bakery Products Output in the Punjab, 1967-1990



Source: Punjab Economic Adviser to the Government, Statistical Abstract of Punjab (annual) and unpublished files at the Punjab Directorate of Industries.

Table 4.16

Net Exports of Wheat and Wheat Flour from the Punjab (percentage to total crop production)

Period	Wheat	Wheat Flour
1967-1970	12.39	0.08
1977-1980	29.61	0.03
1987-1990	25.51	0.02

Note: The net export figures are by rail and river borne traffic only. The percentages are calculated as averages over three years.

Source: India Ministry of Commerce (annual) and Punjab Economic Adviser to the Government, Statistical Abstract of Punjab (annual).

However, the picture this paints for wheat and allied products does not fit all crop (and related) output. In particular, direct agricultural output linkages for cotton and sugar-cane have followed a different path to that of the wheat crop. For both of these crops, production growth in the allied cotton textiles and sugar mills sectors has been substantial (from 139.2 million rupees in 1966/67 to 7,615.6 million rupees in 1989/90 for cotton textiles, and during the same period from 85.1 million rupees to 1,946.7 million rupees for sugar mills). Even so their share of the total value of medium/large-scale manufacturing output in the state has declined. Hence, the output share of cotton textiles decreased from 18.8% in 1966/67 to 14.0% in 1989/90, with the fall for sugar mills being much sharper as it dropped from 11.6% in 1966/67 to 3.6% in 1989/90 (Table 4.17). Similarly, the volume shares of farm cotton and sugar-cane followed a descending course, as did those for cotton textiles and sugar-cane mills (cotton production decreased its share of total farm output from 2.5% in 1966/67 to 2.0% in 1991/92, and with a more extreme decrease in sugar-cane output from 8.4% to 3.2%; Punjab Economic Adviser to the Government, Statistical Abstract of Punjab, annual). Although production shares in the state's total output have decreased for the cotton crop, a corresponding growth did occur in the value of output for farm cotton and cotton textile output (Figure 4.2). For instance, the value of farm cotton produce increased from 213.8 million rupees in 1966/67 to 2,776.8 million rupees in 1989/90, and a similar pattern was followed by cotton textiles (with production growth from 139.2 million rupees in 1966/67 to 7,615.6 million rupees in 1989/90). However, despite these two production trends following a similar path, as Figure 4.2 shows, since that late 1970s cotton textile production has risen much more rapidly than farm cotton output (by value). As this cannot be explained by a sudden divergence in the cost of these two products (see Punjab Economic Adviser to the Government, Statistical Abstract of Punjab, annual, for price changes in both farm cotton and cotton clothing), this points to growth in the manufacturing sector becoming 'uncoupled' from farm output change.

Table 4.17

Production Trends in Cotton Textiles and Sugar Mills in the Punjab (million of rupees)

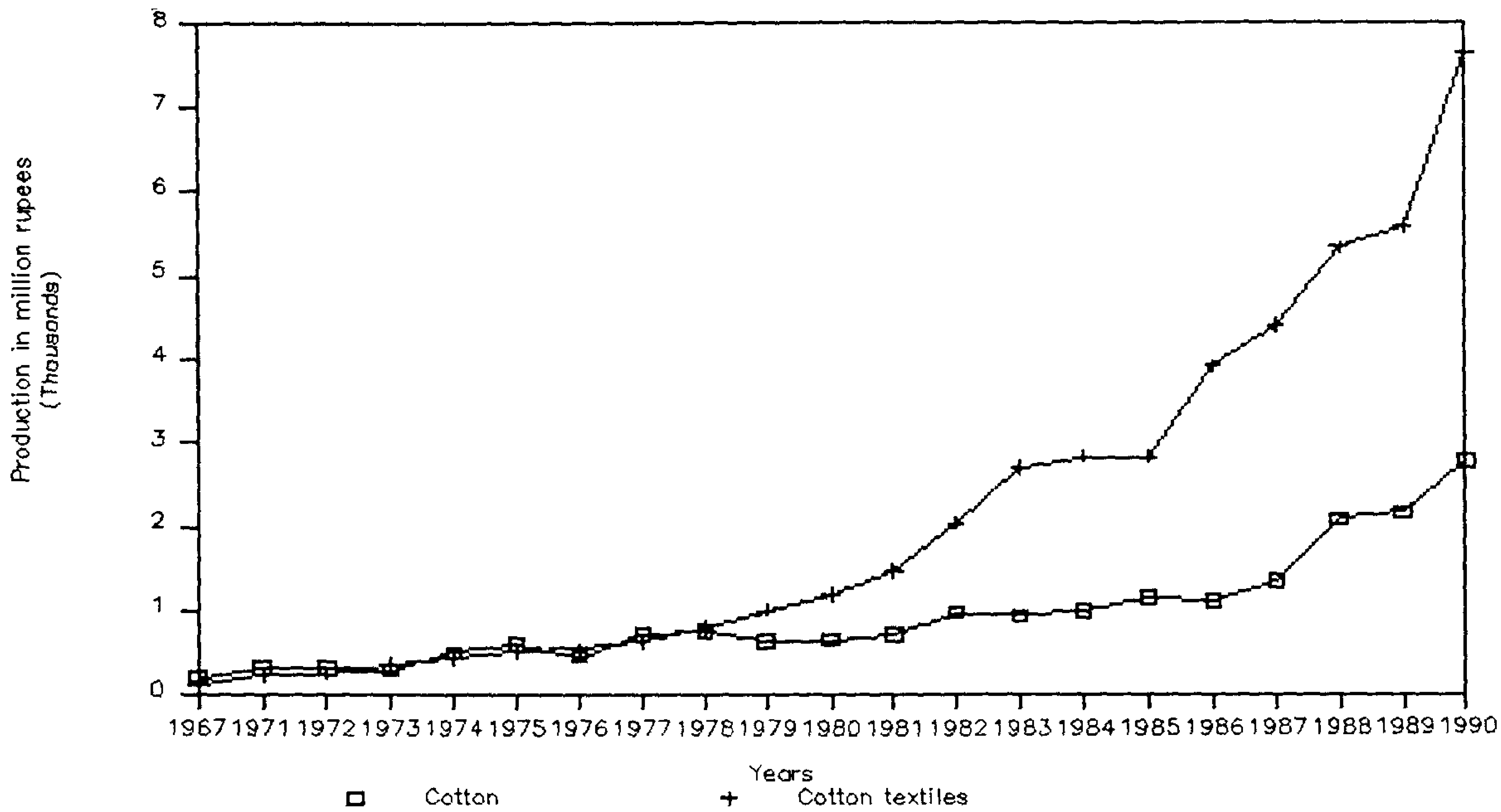
Period	Cotton Textiles		Sugar Mills	
	Production	% share	Production	% share
1966/67	139.2	18.8	85.1	11.6
1970/71	251.0	15.7	78.8	5.0
1971/72	264.8	15.8	62.5	3.8
1972/73	380.2	17.4	82.4	3.7
1973/74	447.0	15.8	137.5	4.9
1974/75	515.1	16.7	160.7	5.2
1975/76	543.2	14.1	206.8	5.4
1976/77	623.2	13.2	208.1	4.4
1977/78	800.4	13.2	253.3	4.2
1978/79	1,010.7	14.2	197.2	2.8
1979/80	1,195.7	12.6	179.5	2.0
1980/81	1,474.9	12.9	311.3	2.7
1981/82	2,039.2	17.0	530.3	4.4
1982/83	2,691.5	18.2	525.6	3.6
1983/84	2,831.2	14.2	562.6	2.8
1984/85	2,828.7	13.7	582.6	2.8
1985/86	3,910.4	15.4	594.4	2.3
1986/87	4,388.2	13.8	965.6	3.0
1987/88	5,326.7	14.1	1,186.6	3.1
1988/89	5,573.3	12.8	1,369.1	3.1
1989/90	7,615.6	14.0	1,946.7	3.6

Note: Share refers to the percentage of total production by value in medium/large-scale manufacturing plants

Source: unpublished files at the Punjab Directorate of Industries.

Figure 4.2

Production of Cotton and Cotton Textiles in the Punjab, 1967-1990

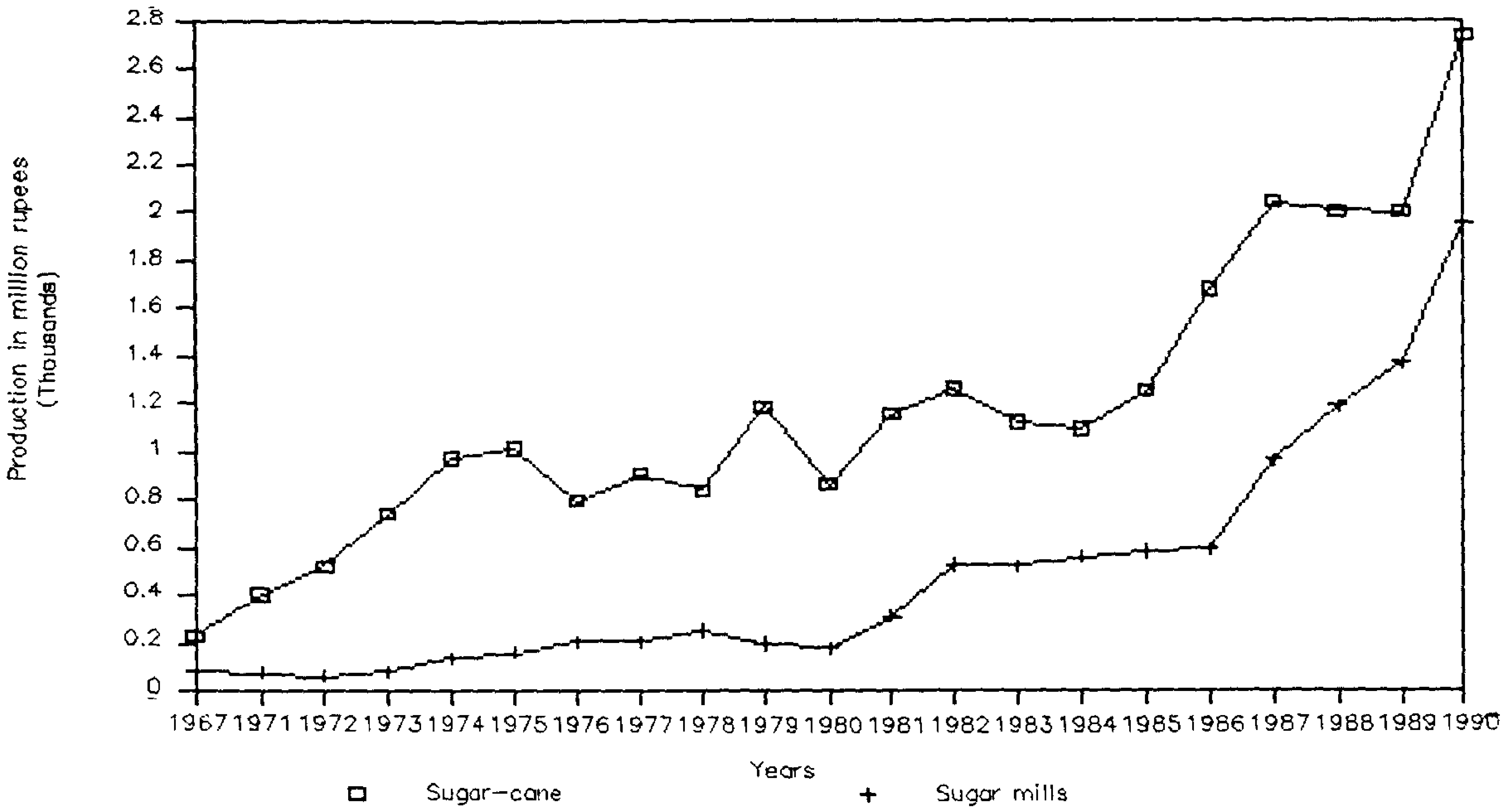


Source: Punjab Economic Adviser to the Government, <u>Statistical Abstract of Punjab</u> (annual) and unpublished files at the Punjab Directorate of Industries.

For sugar-cane and sugar mills production, a similar direction in growth trends is also observable but with crop and industrial plant output following more parallel paths (Figure 4.3). Here the value of farm produce (sugar-cane) grew from 232.4 million rupees in 1966/67 to 2,731.9 million rupees in 1989/90, and during same period sugar-mill output rose from 85.1 million rupees to 1,946.7 million rupees in 1989/90. However, even here, the extent to which increased agricultural production has been put to direct effect in related agro-based manufacturing is open to question. Significantly, the

Figure 4.3

Production of Sugar-cane and Sugar in the Punjab, 1967-1990



Source: Punjab Economic Adviser to the Government, Statistical Abstract of Punjab (annual) and unpublished files at the Punjab Directorate of Industries.

Punjab is a net importer of sugar, with about 60% of its requirements being met from outside the state (Patnaik, 1990). This is so, even though the value of sugar-cane production is higher than that of manufactured sugar (Figure 4.3). By contrast, whereas the output of cotton textile mills has a higher value than that of farm cotton, a large proportion of Punjab's raw (ginned) cotton is sent to the spinning mills of Maharashtra and Gujarat for processing (Aulakh, 1981). Indeed, from 1967 to 1990, the net export of raw cotton varied from between 20%-40% of total farm output, yet there were negligible exports of cotton yarn, for which net export shares ranged from 0.5% to -1.9% over this time period (India Ministry of Commerce, annual).

The seeming lack of association between farm output and manufacturing production increases for these crops is not found for a paddy rice and rice milling (particularly with regard to the share of the total manufacturing output in the state and the contribution to total farm produce). Potentially, this is a key point, for in 1966/67 both rice and rice milling were small players in the state economy, although both had become prominent production sectors by the 1990s. Over this time period, enormous output increases have occurred for rice milling, which had a production value of just 29.6 million rupees in 1966/67 but saw this jump to 5,005.4 million rupees by 1989/90 (Table 4.18). Given the scale of this rise, it might be expected that some growth in local paddy rice output occurred. This certainly was the case, with production of paddy rice rising from 338,000 metric tonnes in 1966/67 to 6.7 million metric tonnes in 1991/92 (Punjab Economic Adviser to the Government, Statistical Abstract of Punjab, annual). By value, this meant that paddy rice output increased from 115.9 million rupees in 1966/67 to 13,548.1 million rupees in 1989/90. Unlike the situation for other crops (and allied manufacturing sectors), this growth resulted in increased shares of total state production. Thus, the contribution of rice milling to the total value of small-scale manufacturing increased from 5.0% in 1974/75 to 14.3% in 1989/90, with an accompanying increased share of paddy rice in the volume of total farm output from 6.5% in 1966/67 to 31.4% in 1991/92. Not only did these two sectors follow similar directions in terms of their growth trends (Figure 4.4), but the suggestion that strong linkages exists between their production is indicated by their export trends, which are quite different from other major crops in the state. Most evidently, exports of paddy make up a much lower proportion of total state output than is the case for processed rice (Table 4.19). Moreover, when we examine the pattern of growth in crop and manufactured output, we see that farm production rose first and still occupies a higher production levels (by value) than rice shelling (Figure 4.4). All of which points to a potential growth-inducing effect of farm activity on the manufacturing sector.

Table 4.18

Production Trends in Rice Milling in the Punjab
(million of rupees)

Period	Production	% share
1966/67	29.6	..
1970/71	97.9	..
1971/72	122.3	..
1972/73	144.2	..
1973/74	177.8	..
1974/75	232.1	5.0
1975/76	806.3	15.0
1976/77	809.4	14.2
1977/78	780.7	11.8
1978/79	1,165.5	15.5
1979/80	1,340.0	15.1
1980/81	1,514.3	13.5
1981/82	1,604.3	12.3
1982/83	1,888.6	13.0
1983/84	2,325.7	13.0
1984/85	2,593.3	13.2
1985/86	3,032.7	14.1
1986/87	3,248.3	13.8
1987/88	3,906.5	14.6
1988/89	4,765.3	15.9
1989/90	5,005.4	14.3

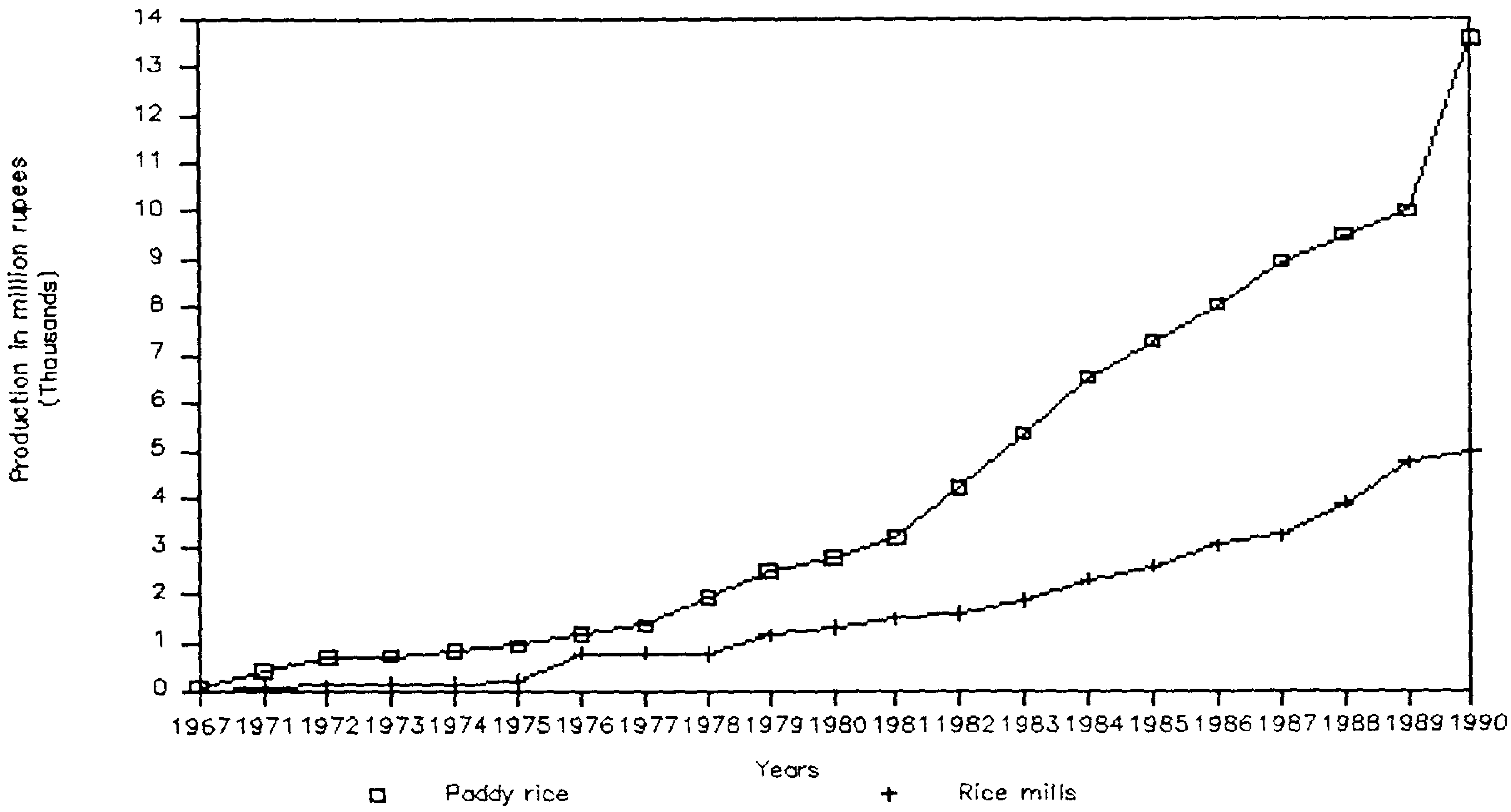
Note: Share refers to the percentage of total production by value in small-scale manufacturing plants

.. data not available

Source: unpublished files at the Punjab Directorate of Industries.

Figure 4.4

Production of Paddy Rice and Rice Shelling Output
in the Punjab, 1967-1990



Source: Punjab Economic Adviser to the Government, Statistical Abstract of Punjab (annual) and unpublished files at the Punjab Directorate of Industries.

Table 4.19

Net Exports of Paddy Rice and Shelled Rice from the Punjab
(percentage of total crop production)

Period	Paddy	Shelled Rice
1967-70	0.5	34.3
1977-80	2.6	45.5
1987-90	0.4	28.4

Note: The net export figures are by rail and river borne traffic only. The percentages are calculated as averages over three years.

Source: India Ministry of Commerce (annual) and Punjab Economic Adviser to the Government, Statistical Abstract of Punjab (annual).

Turning to the supply of manufactured inputs into farming, we find that, unlike rice shelling, there has been no clear-cut pattern of growth in the share of total state production since the Green Revolution began (e.g. Table 4.20, Table 4.21). For instance, during the ten years from 1979/80 to 1989/90, the share of state production in small-scale factories coming from fertilizer plants always stayed between 0.1% to 0.2%, and these shares were between 2.1% to 2.7% for small-scale agricultural machinery manufacturing (even though production increases did happen over the 1979/80 to 1989/90 period, for total production value rose from 15.8 million rupees to 68.2 million rupees for small-scale fertilizer plants and from 206.1 million rupees to 921.0 million rupees for agricultural machinery units). More significant in volume terms was the performance of the state's medium/large-scale factories. Here fertilizer output increased from 86.3 million rupees in 1966/67 to 4,002.3 million rupees in 1989/90, with figures of 3.8 million rupees in 1966/67 to 1,856.4 million rupees in 1989/90 for agricultural machinery production. These output increases are matched with the increased usage of fertilizers on farms and more utilisation of farm implements within the state (Sharma and Dak, 1989), with total crop production increasing sharply since the Green Revolution, so that a ready market existed for these products (Table 4.4). Reflecting these changes, the consumption of fertilizers in the state rose from one kilogram per hectare in 1966/67 to 173 kilograms per hectare in 1991/92 (Punjab Economic Adviser to the Government, Statistical Abstract of Punjab, annual). The number of tractors and threshers increased from 41,000 and 134,000, respectively, in 1971/72, to 269,000 and 367,000 in 1989/90, while the number of harvest combines rose from 570,000 in 1978/79 to 5.0 million in 1989/90 (Punjab Economic Adviser to the Government, Punjab Economy in Figures, annual). However, even with such high growth rates of fertilizer

Table 4.20

Production Trends in Fertilizer Manufacturing in the Punjab
(million rupees)

Period	Medium/Large-Scale Units*		Small-Scale Plants**	
	Production	% share	Production	% share
1966/67	86.3	11.7	..	..
1970/71	115.3	7.2	..	..
1971/72	151.8	9.1	..	..
1972/73	145.1	6.6	..	..
1973/74	230.3	8.1	..	..
1974/75	194.8	6.3	..	..
1975/76	268.4	7.0	..	..
1976/77	295.8	6.3	..	..
1977/78	357.9	6.0	..	..
1978/79	412.3	5.8	..	..
1979/80	856.7	9.1	15.8	0.2
1980/81	1,173.6	10.3	16.8	0.2
1981/82	1,952.5	16.2	22.6	0.2
1982/83	2,411.5	16.3	23.4	0.2
1983/84	2,480.4	12.4	26.1	0.1
1984/85	2,464.3	12.0	30.4	0.2
1985/86	2,840.5	11.2	31.4	0.1
1986/87	2,917.6	9.2	33.2	0.1
1987/88	3,402.0	9.0	34.0	0.1
1988/89	3,415.3	7.8	36.2	0.1
1989/90	4,002.3	7.3	68.2	0.2

*share refers to the percentage of total production by value in medium/large-scale manufacturing plants

**share refers to the percentage of total production by value in small-scale manufacturing plants

.. data are not available

Source: unpublished files at the Punjab Directorate of Industries.

and farm machinery usage, we do not find that the production shares of their companion manufacturing sectors increased (Table 4.20, Table 4.21), even with the prompts of rapid farm production growth. These sectors only grew at a similar pace to general manufacturing activity within the state. Quite possibly, of course, without the introduction of Green Revolution technologies they might have grown more slowly. But this cannot be assessed from a simple listing of annual production figures. More detailed investigation of individual factories is needed to identify if this is the case.

Table 4.21

Production Trends in Agricultural Machinery Manufacturing in the Punjab (million rupees)

Period	Medium/Large-Scale Units*		Small-Scale Plants**	
	Production	% share	Production	% share
1966/67	3.8	0.5	..	..
1970/71	35.8	2.3	..	..
1971/72	38.4	2.3	..	..
1972/73	37.5	1.7	..	..
1973/74	59.1	2.1	..	..
1974/75	111.1	3.6	..	..
1975/76	150.4	4.0	..	..
1976/77	205.9	4.4	..	..
1977/78	221.2	3.6	..	..
1978/79	311.9	4.4	..	..
1979/80	407.0	4.3	206.1	2.3
1980/81	517.3	4.5	259.4	2.3
1981/82	634.8	5.3	308.4	2.4
1982/83	649.6	4.4	356.7	2.5
1983/84	644.4	3.2	383.2	2.1
1984/85	561.8	2.7	412.0	2.1
1985/86	818.9	3.2	485.5	2.3
1986/87	833.1	2.6	523.1	2.2
1987/88	1,081.1	2.9	572.5	2.1
1988/89	1,083.4	2.5	662.5	2.2
1989/90	1,856.4	3.4	921.0	2.7

*share refers to the percentage of total production by value in medium/large-scale manufacturing plants

**share refers to the percentage of total production by value in small-scale manufacturing plants

.. data not available

Source: unpublished files at the Punjab Directorate of Industries.

Conclusion

Having examined temporal trends for crop production and agro-based manufacturing output, close associations between change in farm output and manufactured production only appear to exist for paddy rice and small-scale rice shelling plants. For small-scale manufacturers of farm inputs, a similar pattern of linked output growth is found, although the strength of association with farm output growth is less. However, most growth is in the medium/large-scale manufacturing sector, where scope for spontaneous response to local generated opportunities is less, as government control on production is tight. As for the other agro-based manufacturing activities, their share of total manufacturing output actually declined in some cases (e.g. for sugar-cane, flour mill, biscuit and bakery products and to some extent for cotton textiles). Hence, the analysis undertaken here reveals that the Green Revolution did influence agro-based manufacturing, but that expansion has occurred in many types of manufacturing within the state since the 1960s. Many of the sectors that have experienced growth are unlikely to owe this to farm output rises. Thus, basic metals, chemicals and woollen textiles have dominated increases in medium/large-scale manufacturing output since the 1960s, while the production of bicycles, casting and forging units, sports goods, leather products, and woollen wears have led expansion in the small-scale manufacturing sector (unpublished files at the Punjab Directorate of Industries, 1990).

In reality, from the analysis undertaken here, it is not possible to gauge how far any of this growth can be attributed to the stimulus that was given by rapid agricultural production growth, although existing input-output investigations do suggest that there are some important indirect gains resulting from farm income improvements (Bhalla et al, 1990). Nevertheless, at this stage, the temporal analysis of production change has not provided a strong indication that farm production growth has been critical to manufacturing expansion, except perhaps for rice shelling. Yet, a temporal perspective is just one of the ways of gaining insight on links between agriculture and manufacturing. Another important dimension is the geographical one. This is what we now turn to, to see if agro-based manufacturing is located in areas of the Punjab in which their required raw materials are readily available. The purpose of Chapter Five, thereby, is to assess whether geographical covariation in production across sectors casts further light on the strength of their growth linkages.

Chapter 5

Geographical Covariations in Agricultural and Manufacturing Production within the Punjab

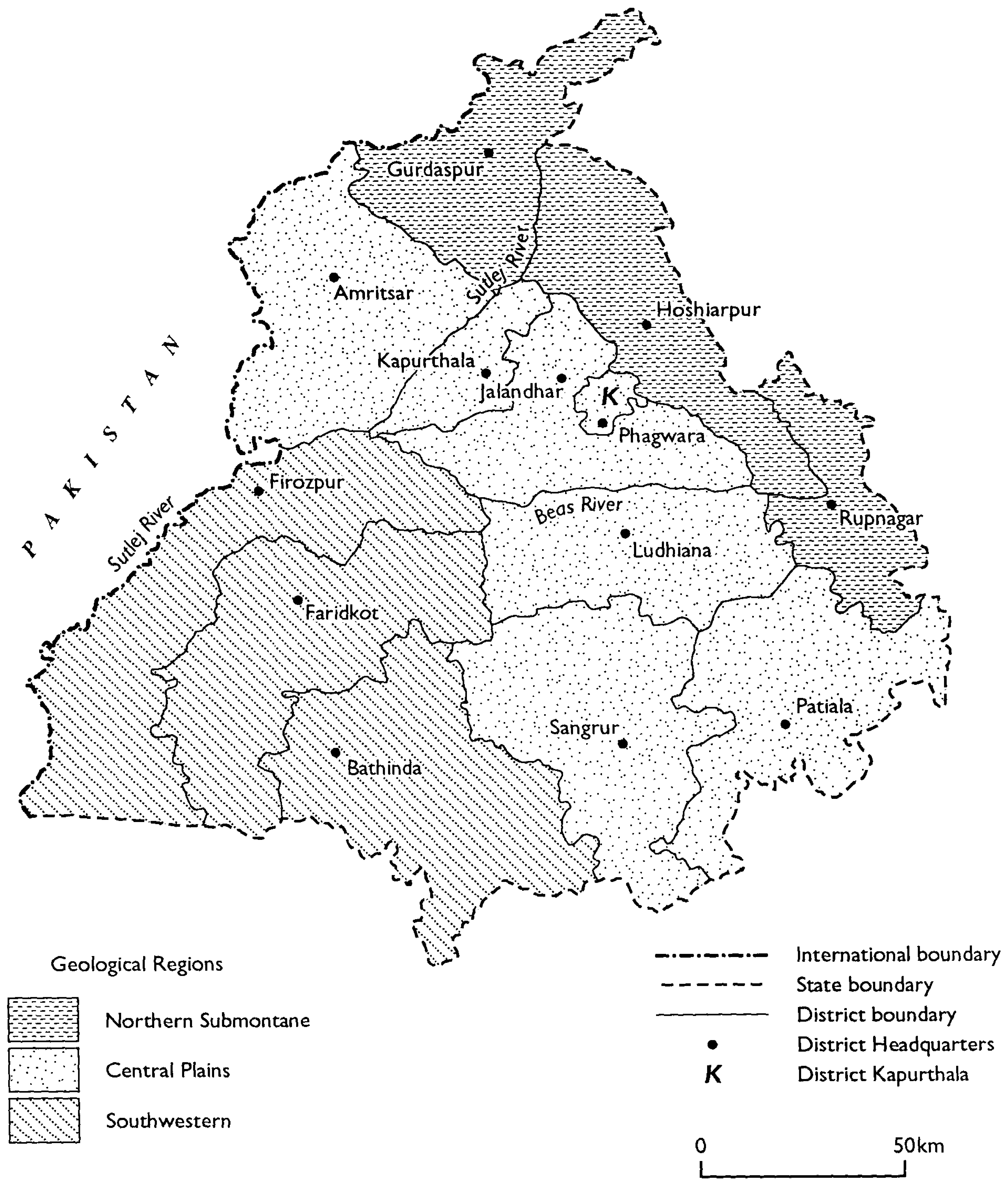
In Chapter Three, it was shown that the Punjab has experienced high rates of economic growth since the onset of the Green Revolution in 1966/67. However, evidence that strong linkages have persisted in the performance of the agricultural and agro-based manufacturing sectors in the following decades is not strong at the state level (Chapter Four). But as temporal linkages represent just one of the ties that bind these two sectors, by themselves they cannot provide a comprehensive impression of growth connections. In particular, for geographers, the geographical pattern of sectoral growth within the state should provide an important indication of potential growth-related linkages. Hence, the main purpose of this chapter is to investigate geographical associations in the growth performances of agriculture and manufacturing within the Punjab. In the first and second sections of the chapter, this will be accomplished by analysing growth trends in agriculture and manufacturing individually. For this interpretation, the 12 districts of the state are used as the geographical units of investigation. Although a more fine-grained geographical division would enable a clearer assessment of growth covariations, analysis on a finer geographical scale (i.e. the 46 tehsils or the 118 blocks of the state) could only be undertaken for the agricultural sector. In fact, districts are the only local units for which data are available as far back as the mid-1960s for both the agricultural and the manufacturing sectors. Even then, unpublished data on agro-based manufacturing are only available from 1980, so there are still restraints on an examination of growth patterns as far back as the Green Revolution. The third section of the chapter then undertakes an interpretation to see if areas of higher agricultural productivity growth have also been prime sites for manufacturing expansion. In essence, this third section will be devoted to evaluating geographical evidence on potential causal relationships that exist between agriculture and manufacturing in the Punjab.

Production Changes in Agriculture

Even though Chapter Four indicates that the Punjab has recorded remarkable rates of growth in agricultural production and productivity since 1966/67, this does not mean that these improvements had an even geographical distribution across the state. The first task for this chapter, therefore, is to identify those areas that recorded the highest growth rates. To achieve this, analysis will focus on the land area that was devoted to particular crops (viz. the cropped area), on crop production levels, and on productivity rates for the four major crops of the state; namely, wheat, paddy rice, cotton and sugar-cane. As was noted in the previous chapter, these four crops dominate farm production in the Punjab, yet they reveal somewhat different temporal associations with changes in manufactured output in allied agro-processing industries. Geographically, of course, we would expect production change to have some roots in the uneven advantages of areas within the state for farm production. Critical to this pattern of differential advantage is the state's physiographical conditions (Day and Singh, 1977; Gosal and Krishan, 1984; Singh, 1990). And as this physiography is less subject to human interference, it is here that we need to start our consideration of the geographical incidence of farm production.

For descriptive purposes, the Punjab can be divided into three geographical regions (Figure 5.1): the (hilly) northern submontane strip (the northeastern part of the state), the central plains (which does occupy the central part of the state), and the drier southwestern region (McGuirk and Mundlak, 1991). The submontane strip in the north contains major portions of the districts of Gurdaspur, Hoshiarpur, and Rupnagar. Despite an average annual rainfall for this area of about 87 centimetres, agricultural productivity is low relative to that of the other two regions in the Punjab (Bhalla and Khan, 1979). In good part this is due to the hilly nature of the area, for the submontane strip includes the Siwalik hills and an adjoining foothills tract which together occupy about one-eighth of the state's area. Effectively, the entire zone is characterised by an undulating and dissected topography drained by seasonal streams. Soil erosion and a scarcity of underground water are the bane of this region, yet agriculture provides its main economic activity (Gosal and Krishan, 1984). By contrast, in the central plains, which are comprised almost exactly of the districts of Amritsar, Kapurthala, Jalandhar, Ludhiana, Patiala, and (most of) Sangrur, there are three perennial rivers and many canals that flow through the region. Here, the average annual rainfall is 57 centimetres. Alluvial soils, good quality underground water, along with this rainfall, make the region the most productive farming area in the Punjab (Gosal and Krishan, 1984; McGuirk and Mundlak, 1991). The southwestern region offers another contrast. It contains the districts of Ferozepur, Bhatinda, Faridkot, and the westerly parts of Sangrur. The average annual rainfall in the area is 27 centimetres, of which 23 centimetres are received during the monsoon rains (McGuirk and Mundlak, 1991). This region does not possess a rich reservoir of underground water like central Punjab, and it is spotted with a large number of sand dunes which have advanced from the neighbouring

Figure 5.1
The Districts of Punjab



Source: Census of India, 1991b

Thar Desert. The region as a whole is marked by a greater proportion of sand in its soil than elsewhere in the state (Singh, 1990), with the influence of the Thar Desert making the soil of this area lighter and less productive than soil on the plains of central Punjab, which are composed of alluvial material. What this means is that both the southwest region and northeastern Punjab are marked by less productive soils, although in the northeast this is more due to the erosive action of running water.

As well as physiographical conditions, the presence of adequate water supplies is a key factor accounting for variation in agricultural growth within the state (Singh, 1990). Rainfall in the state is not only inadequate and seasonally concentrated but is also quite unreliable. The stability and success of farming in the state is therefore linked to the development of irrigation. This is well recognised by state officials, and successive governments of the state have laid much emphasis on the need for an extension of the land area under irrigation (Sharma and Dak, 1989). But even here, the advantages of the central plains in terms of its topography, soft alluvial soil strata and the rich reservoir of underground water, have played their own role in the extension of the irrigated land area. Northeastern Punjab, being dominated by the Shiwalik hills and adjoining foothill plains, is the least irrigated area in the state. The undulating and dissected topography of this region has restricted the extension of canals, while deep and inadequate sub-soil water has hindered tube-well irrigation. Within this region only a small amount of irrigation is practised, and this is only done by using tube-wells. Southwestern Punjab is also less irrigated than the centre. Here, tube-well irrigation can not make much headway due to the brackish nature of underground water. Fortunately, the southwest region is advantaged somewhat by its relative flatness, so that it has been able to develop canals as a source of its irrigation. By contrast, physiographic conditions in central Punjab are well suited to irrigation and this is the most irrigated part of the state, with both tube-wells and canals being extensively developed in the region.

As well as irrigation, farming in the state is assisted by climatic conditions which allow for the possibility of double cropping. The winter harvest begins in November and continues until March. This part of the year is known locally as the 'rabi' crop season, which mainly involves the cultivation of wheat and green fodder. The summer season is then from April to October. This agricultural season is referred to locally as the 'kharif' season. The main kharif crop is paddy rice. Cotton and sugar-cane are also considered as kharif crops, although cotton is sown earlier than most other kharif crops and sugar-cane is sown from February to April and harvested between December and March (Singh, 1990). To provide an appreciation across all districts of performances for rabi and kharif crops since the mid-1960s, the area sown and production levels of wheat, paddy rice, cotton and sugar-cane are investigated in the following section.

Before looking at these crops individually, we should note that in each district in the state, the total land area that was cropped expanded dramatically over the period 1967 to 1991. But although this measure of enhanced agricultural performance was experienced by all districts in the state, its effect was less notable in the northeastern districts of Hoshiarpur and Rupnagar (Table 5.1). Before examining the nature of this increase in cropped area, two points should be made. The first is simply to emphasise that crops dominate the farm economy of the Punjab. Thus in 1991/92, 83.9% of farm land in the state was under crops. The second is to note that the reasons for the poorer growth performances of Hoshiarpur and Rupnagar are

Table 5.1

Total Cropped Area by District (000s hectares)

Districts	1967/71	1978/81	1988/91	Percentage Change
Amritsar	561	679	781	39.2
Bhatinda*	622	795	832	33.8
Faridkot*	622	809	905	45.5
Ferozepur*	622	769	924	48.6
Gurdaspur	349	434	466	33.5
Hoshiarpur	326	382	394	20.9
Jalandhar	380	475	518	36.3
Kapurthala	156	213	248	59.0
Ludhiana	465	570	602	29.5
Patiala	495	675	725	46.5
Rupnagar	177	196	205	15.8
Sangrur	633	769	873	37.9
Punjab	5,408	6,766	7,473	38.2

Cropped Area = Net area sown + Area sown more than once.

*Faridkot district was only created in 1972. Nearly 70% of its area was originally in the district of Ferozepur and approximately 30% of its area was in the old district of Bhatinda. The figures for 1967/71 period have been estimated by dividing the total cropped area for the Bhatinda and Ferozepur districts into three equal parts, as the three new districts are of roughly equal size.

Source: Punjab Economic Adviser to the Government, Statistical Abstract of Punjab (annual).

the undulating and dissected topography of the submontane region (see Singh, 1990).

Wheat Production

In each district, a sizeable proportion of the expansion that has occurred in the cropped area since 1967 is accounted for by increases in the area under wheat cultivation. Indeed, the proportion of the total cropped area of the state

Table 5.2

Production of Wheat by District
(000s metric tonnes)

Districts	1967/71	1988/91	Percentage Rise
Amritsar	556	1,307	135.1
Bhatinda*	468	1,172	150.4
Faridkot*	468	1,404	200.0
Ferozepur*	468	1,506	221.8
Gurdaspur	288	641	122.6
Hoshiarpur	180	459	155.0
Jalandhar	411	813	97.8
Kapurthala	150	415	176.7
Ludhiana	683	1,121	64.1
Patiala	488	1,287	163.7
Rupnagar	107	255	138.3
Sangrur	618	1,625	162.9
Punjab	4,885	12,005	145.8

*Faridkot district was only created in 1972. Nearly 70% of its area was originally in the district of Ferozepur and approximately 30% of its area was in the old district of Bhatinda. The figures for 1967/71 period have been estimated by dividing the total wheat production for the Bhatinda and Ferozepur districts into three equal parts, as three new districts are of roughly equal size.

Source: Punjab Economic Adviser to the Government, Statistical Abstract of Punjab (annual).

under wheat that comes from each of the districts did not alter by much over the 1967/71 to 1988/91. Primarily this is because the volume of increase in the cropped area under wheat mainly fell at around 50% for all the districts (Punjab Economic Adviser to the Government, Statistical Abstract of Punjab, annual). Significantly, despite broad similarities in the growth of the cropped area, there were important regional differences in levels of wheat production (Table 5.2). The lowest percentage rises at the district level (1967/71-1988/91) were in central Punjab (i.e. in Jalandhar and Ludhiana districts), while at the regional level, although the southwestern parts of the state (Bhatinda, Faridkot and Ferozepur) were not the major wheat producing areas in 1967/71, by 1988/91 they had joined with the central areas to take top position. In 1988/91, the Sangrur district of the central plains took the highest position of any district in wheat production, but its production share in total state output only increased from 12.6% in 1967/71 to 13.5% in 1988/91. By contrast, the shares of the Faridkot and Ferozepur districts of southwestern Punjab rose from shares of 9.6% and 9.6% in 1966/67 to 11.7% to 12.5% in 1988/91, respectively.

While the land area under wheat and its farm output provide an indication of the local importance of this crop, the agricultural prosperity of a district can be gauged more appropriately by yield variability. In wheat yield terms, substantial increases were recorded for all districts. But it is notable that the most significant improvements were found in areas with less productive soils (in the southwest and northeast), rather than in central Punjab. For instance, from 1967/71 to 1988/91, the highest percentage rises at the district level were all found in the southwest (i.e. Bhatinda, Faridkot and Ferozepur districts) and a district in northeast region held fourth position (i.e. Hoshiarpur). These more impressive productivity increases can largely be explained by improved irrigation facilities in the southwest (Singh, 1990). Although these areas enjoyed less assured irrigation relative to the central area, they were also less prone to wheat diseases (Grewal and Rangi, 1985). Of course, irrigation was not the only factor behind these productivity improvements, for it has been noted '...that the adoption of MV [modern varieties] wheat was extremely rapid, with over one-third of the area planted to wheat being sown to the new varieties in the first year of availability, and by 1969/70, only three years later, this rate had increased to about 70 percent. This indicates that factors that are often thought to slow down the pace of adoption of new varieties, such as lack of information, uncertainty, or institutional constraints, did not play an important role in the case of wheat' (McGuirk and Mundlak, 1991, p23). During the mid-1970s, even in the submontane districts of Gurdaspur and Rupnagar, the entire irrigated area under wheat had come under high yielding varieties of seeds (Chadha, 1986). Indicative of this point, after the onset of the Green Revolution, 27 new varieties of wheat were released by Punjab Agricultural University (Gill, 1989).

Paddy Rice Production

Compared to wheat production, it is notable that much more variability has been revealed in change in the areal coverage of paddy rice (rice in husk). At one extreme, the cropped area increased by less than two-fold in the Gurdaspur and Hoshiarpur districts of northeastern Punjab (from 78,000 hectares in 1967/71 to 115,000 in 1988/91 for Gurdaspur and from 30,000 to 59,000 hectares for Hoshiarpur). However, in general, the land area devoted to paddy rice grew much more substantially in central Punjab, with more than a 50-fold increase in Ludhiana, a 26-fold growth in Sangrur, and a 12-fold rise in the Jalandhar district (Punjab Economic Adviser to the Government, Statistical Abstract of Punjab, annual). Hence, the land area of paddy rice in Ludhiana, Sangrur and Jalandhar districts grew from 4,000, 11,000, and 13,000 hectares, respectively, for 1966/71, to 222,000, 283,000 and 155,000 hectares in 1988/91. These increases were matched by dramatic growth in the share that these districts had in the state's total land area under paddy rice, from 1.1% to 11.5% for Ludhiana, from 3.0% to 14.6% for Sangrur and from 3.6% to 8.0% for Jalandhar. In terms of production growth, the increase in cropped area was linked to an even more heightened impact owing to higher productivity increases in the central plains, which resulted from their more fertile and irrigated lands. Notably for paddy rice, productivity in northeastern and southwestern Punjab rose by less because of the lighter and more porous soils of these regions (Gosal and Krishan, 1984). Even so, productivity has risen in both the hilly northeastern and the sandy southwestern areas. For instance, productivity increased from 1,373 to 2,903 kilograms per hectare over the 1967/71 to 1988/91 period in Hoshiarpur (in northeastern Punjab), and during the same period the increase was from 1,126 to 3,588 kilograms per hectare in the Bhatinda district of southwestern Punjab. This meant that total output in Bhatinda rose from an estimated 31,000 metric tonnes in 1967/71 to 185,000 tonnes in 1988/91. Overall, however, the most dramatic post-1967 changes in the volume of paddy rice production occurred in the Ludhiana, Sangrur and Jalandhar districts of central Punjab. In Ludhiana, this brought a rise in the share of the state's total paddy rice production by volume from 1.1% in 1967/71 to 12.7% in 1988/91. Similar huge increases took place in Sangrur and Jalandhar districts, which saw their figures move from 2.5% and 3.7%, respectively, to 16.0% and 7.9% (Punjab Economic Adviser to the Government, Statistical Abstract of Punjab, annual). Indeed, while paddy rice was rarely grown in these districts in 1967, by 1991 Ludhiana had changed from being the district with the smallest 1967/71 production level in the state to the second most prominent producer (after the Sangrur district). Thus, total production in Ludhiana rose from 6,000 to 841,000 metric tonnes, with Sangrur showing an increase from 14,000 to 1.1 million metric tonnes (Table 5.3).

The reasons for the dramatic increase in production in the central plains have been explained by analysts as resulting from the location of these districts on the fertile flood plain of the rivers in central Punjab, which has enabled the more ready development of superior irrigation systems which

Table 5.3

Production of Paddy Rice by District
(000s metric tonnes)

Districts	1967/71	1988/91	Percentage Change
Amritsar	140	786	461.4
Bhatinda*	31	185	496.8
Faridkot*	31	521	1,580.6
Ferozepur*	31	733	2,264.5
Gurdaspur	115	455	295.7
Hoshiarpur	41	181	341.5
Jalandhar	21	522	2,385.7
Kapurthala	44	297	575.0
Ludhiana	6	841	13,916.7
Patiala	84	950	1,031.0
Rupnagar	6	112	1,766.7
Sangrur	14	1,063	7,492.9
Punjab	564	6,646	1,078.4

*Faridkot district was only created in 1972. Nearly 70% of its area was originally in the district of Ferozepur and approximately 30% of its area was in the old district of Bhatinda. The figures for 1967/71 period have been estimated by dividing the total paddy rice production for the Bhatinda and Ferozepur districts into three equal parts, as three new districts are of roughly equal size.

Source: Punjab Economic Adviser to the Government, Statistical Abstract of Punjab (annual).

are particularly suited to paddy rice cultivation (Singh, 1990). But even given the advantages of the central plains, it is notable that both Ferozepur and Bhatinda districts in southwestern Punjab continued to play a significant role in paddy rice production, which undoubtedly owes much to the availability of canal-based irrigation systems in their region (Ferozepur, for instance, contributed 13.4% of total state production in 1978/81 and still accounted for 11.0% in 1988/91). Overall, the area sown to modern varieties of paddy rice was only 20% by 1969/70 across the state as a whole, yet by 1971/72 the adoption rate for modern varieties of paddy rice matched that for modern varieties of wheat (McGuirk and Mundlak, 1991). Indicative of the importance of Green Revolution technology in this growth, Gill (1989) points out that after the onset of the Green Revolution, 22 varieties of high-yielding paddy rice were adopted for cultivation. Overall, the geographical distribution of paddy rice is found to have its strongest concentrations in the districts of central Punjab (i.e. Ludhiana, Sangrur, Jalandhar and Patiala), with production also being important in some parts of southwestern Punjab (Bhatinda and Ferozepur districts).

Cotton Production

Here changes in production mirror what has happened to the area of cultivation under this crop. Very noticeably, there was a process of spatial concentration in production, with cotton output focusing increasingly on the southwestern districts of the state. So, while the Bhatinda, Faridkot and Ferozepur districts together had 68.7% of the state's total area under cotton in 1967/71, by 1988/91 this had risen to 91.2%. Over the same period the production share of these three districts rose from 75.0% to 91.7% (Punjab Economic Adviser to the Government, Statistical Abstract of Punjab, annual). Apart from these districts the only increase in areal coverage and farm cotton production happened in the Sangrur district of central Punjab, which is adjacent to the southwestern districts, with part of this district having physiographical conditions closer to the southwest than to the central plains. But even here, production growth was much less notable than in the southwestern districts. So, while cotton output in Sangrur has risen by just over 100% since the Green Revolution started, in Bhatinda and Faridkot the rate of increase was more than 250% (Table 5.4).

Table 5.4

Production of Cotton by District
(000s metric tonnes)

Districts	1967/71	1988/91	Percentage Change
Amritsar	7	0	-100.0
Bhatinda*	36	152	322.2
Faridkot*	36	133	269.4
Ferozepur*	36	80	122.2
Gurdaspur	1	0	-100.0
Hoshiarpur	1	1	0.0
Jalandhar	2	0	-100.0
Kapurthala	1	0	-100.0
Ludhiana	6	6	0.0
Patiala	6	1	-83.3
Rupnagar	0	0	0.0
Sangrur	12	25	108.3
Punjab	144	398	176.4

*Faridkot district was only created in 1972. Nearly 70% of its area was originally in the district of Ferozepur and approximately 30% of its area was in the old district of Bhatinda. The figures for 1967/71 period have been estimated by dividing the total cotton production for the Bhatinda and Ferozepur districts into three equal parts, as three new districts are of roughly equal size.

Source: Punjab Economic Adviser to the Government, Statistical Abstract of Punjab (annual).

The primary reason for output growth in the southwestern part of the state was the introduction of 12 new varieties of American Cotton and four high-yielding varieties of 'Desi' cotton after the onset of the Green Revolution (Gill, 1989). These new varieties were well suited for the semi-dry climate and porous soils of southwestern Punjab, with the considerable development of canal irrigation in this region further enhancing the excellent conditions that existed for these new varieties of cotton (Singh, 1990). Indeed, while yield per hectare advanced in Bhatinda, Faridkot and Ferozepur districts, it decreased in all the districts of northeastern and central Punjab except Hoshiarpur in northeastern part of the state. Not surprisingly, given marked yield improvements for other crops, and the suitability of drier areas for new high yielding cotton varieties, dramatic decreases in the land area given over to farm cotton production occurred in most northeastern and central districts. For instance, in the Amritsar and Ludhiana districts of central Punjab, the land area decreased from 25,000 and 19,000 hectares in 1967/71 to 1,000 and 3,000 hectares in 1988/91, respectively (Punjab Economic Adviser to the Government, Statistical Abstract of Punjab, annual). The overall geographical picture for farm cotton production, then, is one of movement toward a near monopoly situation for the southwestern districts.

Sugar-cane Production

This crop reveals yet another pattern of clear change in the geography of production. Output was fairly evenly distributed across districts in the mid-1960s, but over the last 25 years there has been a decline in output levels in the majority of districts, with a contrasting trend of production growth in the Jalandhar and Kapurthala districts of central Punjab, as well as throughout northeastern Punjab (Gurdaspur, Hoshiarpur and Rupnagar; Table 5.5). In fact, productivity in sugar-cane production rose in all districts after 1967, but the land area given over to this crop decreased in all parts of the state other than in the northeast and in two districts of central Punjab (Punjab Economic Adviser to the Government, Statistical Abstract of Punjab, annual).

Competition from Green Revolution 'kharif' crops like paddy rice largely accounted for where decline occurred (as it did for some other crops, such as maize and pulses), for two harvests of paddy and wheat can be raised from the same field in a single year, as against a single crop of sugar-

Table 5.5

Production of Sugar-cane by District
(000s metric tonnes)

Districts	1967/71	1988/91	Percentage Change
Amritsar	57	30	-47.4
Bhatinda*	31	9	-71.0
Faridkot*	31	11	-64.5
Ferozepur*	31	40	29.0
Gurdaspur	82	110	34.1
Hoshiarpur	28	77	175.0
Jalandhar	70	151	115.7
Kapurthala	13	20	53.8
Ludhiana	48	46	-4.2
Patiala	63	51	-19.0
Rupnagar	44	72	63.6
Sangrur	61	30	-50.8
Punjab	559	647	15.7

*Faridkot district was only created in 1972. Nearly 70% of its area was originally in the district of Ferozepur and approximately 30% of its area was in the old district of Bhatinda. The figures for 1967/71 period have been estimated by dividing the total paddy rice production for the Bhatinda and Ferozepur districts into three equal parts, as three new districts are of roughly equal size.

Source: Punjab Economic Adviser to the Government, Statistical Abstract of Punjab (annual).

cane (Singh, 1990). Thus, we see that in the districts of Patiala, Amritsar, Sangrur and Bhatinda, the area devoted to sugar-cane fell from 15,000, 14,000, 13,000, and 12,000 hectares, respectively, in 1967/71, to figures of 7,000, 5,000, 5,000 and 2,000 hectares in 1988/91. In the same districts, paddy rice saw an increase in its land area from 57,000, 81,000, 11,000 and 1,000 hectares in 1967/71, to 1988/91 figures of 277,000, 278,000, 283,000 and 52,000 hectares, respectively (Punjab Economic Adviser to the Government, Statistical Abstract of Punjab, annual). But what then accounts for growth having occurred in some of the districts. According to Singh (1990, p27) the key factor has been the location of existing sugar mills, so that today '...most of the commercial cultivation of cane is confined to the catchment areas of the sugarmill'. This arises because, in Punjab, as elsewhere in India, a certain land area is allocated to each mill and cane produced within this area is brought directly to the mill for crushing (this administrative factor of restricting sugar-cane production to within the sugar mill's catchment area will be explained when manufacturing activity is considered).

Summary

Analysis of the cropped area, of productivity rates and of farm production output for the major crops of the state reveals that total farm production has improved across all districts since the Green Revolution began. But the benefits of high growth in wheat, paddy rice, cotton and sugar-cane were not shared equally across the geographical divisions of the state. Assuming that farm production growth is linked to increases in agro-processing activity, this provides us with a set of expectations regarding the geographical distribution of growth in agro-based manufacturing. For instance, manufacturing based on wheat processing should be found to have increased across all areas in each of the northeastern, central and southwestern regions of the Punjab. By contrast, processing based on paddy rice as a raw material might be expected to be more heavily concentrated in the districts of Ludhiana, Sangrur, Jalandhar and Patiala in central Punjab, as well as in Ferozepur and Bhatinda in the southwest. The most peculiar districts in cotton production are those of Bhatinda, Faridkot, Ferozepur and Sangrur (for the land area devoted to this crop and production levels have decreased in other places), so that cotton textile manufacturing might be assumed to be or to have become more highly focused on the southwestern areas of the state. As for sugar-cane, its incidence of high growth is found in parts of the central plains (Jalandhar and Kapurthala districts) and in northeast Punjab (Gurdaspur, Hoshiarpur and Rupnagar districts).

The Geography of Manufacturing Growth

Ideally, the aim of this section should be to measure inter-district variations in the volume and rate of manufacturing growth since the mid-1960s. Unfortunately, the absence of regular, comprehensive statistics on manufacturing output is a major obstacle for such an analysis. This is because data are available in different forms for various categories of production unit. For registered manufacturing plants, for instance, secondary sources of data are available on manufacturing activity at the district level from 1972, but this information only covers the number of manufacturing plants and employment levels within factories (and these data are only obtainable according to categories in the standard national classification of manufacturing plants, which does not even distinguish a class for agro-based manufacturing). Published data on 'registered' manufacturing activities are also limited in scope. This is because government regulations only require factories of a certain size to be registered. As a result information on registered factories only includes those plants which employ ten or more workers if the factory uses electric power in its production process or units that employ 20 or more workers if they do not use electric power. Fortunately, for agro-based processors, unpublished information on small-scale manufacturing enterprises is obtainable from 1979/80 from the Punjab Directorate of Industries. However, these data are not available below the district level (in 1991 small-scale factories were defined as those enterprises in which capital investment did not exceed six million rupees). From the same source, unpublished files on medium/large-scale manufacturing units are available from 1980/81 (for those manufacturing plants that are registered under the National Industrial Act, 1951), but this information can be collected for each agro-based manufacturing plant in the state. However, to make the analysis of manufacturing production equivalent across all sources of information, the data from such plant-level figures have been aggregated to the district level so they can be compared with small-scale factory information.

The major concern for the spatial investigation undertaken here is to see if areas which have a distinct farm output performance are the same as those which specialise in the manufacturing activity which is based on the same crop. In the analysis most attention is therefore given to distributional changes in the output of small, medium and large-scale agro-processors. Discussion of other registered manufacturing activities, like food products, paper products, basic metal and machinery products, will also be included in general terms, although the variety of inputs used in these production processes (and the variety of their output) makes it inappropriate to think in terms of tying their production changes to any single farm crop. But the reasons for any spatial concentration or dispersal of manufacturing in these sectors will be singled out, to see if there is any suggestion of a connection with surrounding agricultural output changes.

In general, phenomenal growth took place in the number of registered manufacturing factories in the Punjab from 1972 to 1991 (across the state as a whole 143.0% of the production units in existence today were set up during this period, while the number of workers increased by 223.5%;

Punjab Economic Adviser to the Government, Statistical Abstract of Punjab, annual). Geographically, registered manufacturing plants have been concentrated historically in the districts of Amritsar, Jalandhar and Ludhiana (Table 5.6). In terms of the number of production units, state's manufacturing industries continue to be dominated by these three districts, which accounted for 59.4% of all registered factories in 1991 (down from 66.5% in 1972).

What is nonetheless clear is that different manufacturing sectors show varying patterns of concentration and dispersal. Throughout the period from 1972 to 1991, the manufacturing of wool and silk, leather, rubber, metal products and transport equipment were always concentrated in the central Punjab districts of Amritsar, Jalandhar and Ludhiana. For instance, employment in wool and silk manufacturing was dominated by Amritsar and Ludhiana, which contributed 73.9% (1972), and then 81.5% (1991), of all wool and silk workers (Punjab Economic Adviser to the Government, Statistical Abstract of Punjab, annual). Likewise, the Jalandhar district held a commanding position for the production of leather products, with 56.9% of all of the state's workers in this sector in 1972 and 57.8% in 1991. Continuing this pattern of concentration with little change over time, rubber products, metal products and transport equipment manufacturing were dominated by Amritsar, Jalandhar and Ludhiana (although with significant shares by Patiala and Sangrur districts in chemicals and non-metallic mineral manufacturing). Thus, 83.2% of the 1972 employment numbers in rubber manufacturing, and 87.9% of the total in 1991, were shared between Amritsar, Jalandhar and Ludhiana districts, while their contribution to the metal products workforce was 83.7% in 1972 and 82.9% in 1991. These three districts also dominated transport equipment manufacturing, with 84.8% of the state's workforce in 1972 and 76.3% in 1991.

Table 5.6

Number of Registered Working Factories by District

Districts	1972*	1981	1991	Percentage Change
Amritsar	989	1,235	1,721	74.0
Bhatinda	151	241	530	251.0
Faridkot	144	330	580	302.8
Ferozepur	128	240	480	275.0
Gurdaspur	337	518	595	76.6
Hoshiarpur	88	239	353	301.0
Jalandhar	774	1,033	1,482	91.5
Kapurthala	184	246	347	88.6
Ludhiana	1,442	2,109	3,748	159.9
Patiala	367	557	859	134.1
Rupnagar	59	205	339	474.6
Sangrur	154	362	671	335.7
Punjab	4,817	7,315	11,705	143.0

*data for all districts are only available from 1972.

Source: Punjab Economic Adviser to the Government, Statistical Abstract of Punjab (annual).

In contrast with the focusing of the above sectors in the traditional manufacturing heart of the state, the distributional pattern for a few manufacturing sectors, like food products, paper, basic metals, and machinery (which includes agricultural machinery but excludes electrical machinery), is spread more widely. Here, there is a notable presence across the northeastern districts of Hoshiarpur and Rupnagar, as well as in the southwestern districts of Bhatinda, Faridkot and Sangrur (although the central districts of Amritsar, Ludhiana, Patiala are also major producers in these sectors). This pattern is seen not simply in 1991 figures but also in changes that have occurred since the late-1960s. For instance, a remarkable growth has occurred in food processing activity in southwestern Punjab in the last 20 years. Indeed, from 1972 to 1991, the highest percentage increases were

Table 5.7

Number Employed in Food Products Manufacturing by District

Districts	1972*	1981	1991	Percentage Change
Amritsar	1,438	2,182	6,687	365.0
Bhatinda	146	1,080	2,446	1,575.3
Faridkot	772	2,077	4,061	426.0
Ferozepur	496	1,676	5,804	1,070.2
Gurdaspur	1,079	1,767	3,418	216.8
Hoshiarpur	124	410	750	504.8
Jalandhar	1,982	2,142	3,429	73.0
Kapurthala	1,237	1,305	2,683	116.9
Ludhiana	1,617	2,429	6,496	301.6
Patiala	2,289	4,291	9,345	308.3
Rupnagar	343	830	1,683	390.7
Sangrur	649	1,968	9,515	1,366.1
Punjab	12,172	22,157	56,317	362.7

*data for all districts are only available from 1972.

Source: Punjab Economic Adviser to the Government, Statistical Abstract of Punjab (annual).

found in this area (i.e. in Bhatinda, Ferozepur, and the adjoining Sangrur district; Table 5.7).

Similar significant distributional changes occurred for paper manufacturing, although not in the same manner as for food processing. In 1972, employment in paper manufacturing was insignificant in both the northeastern and the southwestern parts of the state, which only accounted for 7.2% of employment in this sector in that year. However, by 1991 45.0% of workers were in these zones, with Hoshiarpur seeing its employment total rise from 14 people to 2,652 workers over the 1972 to 1991 period (Table 5.8). This resulted in Hoshiarpur district having 27.3% of the state's employment in paper manufacturing at the latter date. A similar growth pattern was found in the southwestern district of Sangrur, where not even a single person was

Table 5.8

Number Employed in Paper Manufacturing by District

Districts	1972*	1981	1991	Percentage Change
Amritsar	46	177	680	1,378.3
Bhatinda	0	0	116	**
Faridkot	15	96	902	5,913.3
Ferozepur	75	53	111	48.0
Gurdaspur	20	18	377	1,785.0
Hoshiarpur	14	940	2,652	18,842.9
Jalandhar	684	640	892	30.4
Kapurthala	0	0	98	**
Ludhiana	483	599	1,204	149.3
Patiala	614	541	1,016	65.5
Rupnagar	14	8	209	1,392.9
Sangrur	0	512	1,463	**
Punjab	1,965	3,584	9,720	394.7

*data for all districts are only available from 1972.

**not calculated as 1972 figure is zero.

Source: Punjab Economic Adviser to the Government, Statistical Abstract of Punjab (annual).

engaged in paper manufacturing in 1972, yet by 1991 Sangrur had 15.0% of the state's employment in paper manufacturing.

This pattern of growth occurring in zones that previously recorded little output from a particular manufacturing sector was further illustrated by employment in basic metals manufacturing. For this sector the performance of northeastern districts stands out, with an employment rise from zero in 1972 to 2,275 in 1991 in Hoshiarpur and from 8 to 893 in Rupnagar (Punjab Economic Adviser to the Government, Statistical Abstract of Punjab, annual). Rupnagar district also had a peculiar growth pattern in machinery production which includes agricultural machinery (but excludes any electrical machinery), for this sector saw a 12-fold employment gain in this district between 1972 and 1991.

In fact, one of the particular characteristics of manufacturing expansion in the state has been the increased importance of the northeastern and southwestern districts after 1970 (especially for the manufacture of food products, paper, basic metals and electric machinery). For instance, out of all six medium/large-scale food products manufacturing plants that existed in the northeastern region in 1991, five were set-up after 1970. Moreover, of the 15 medium/large-scale paper manufacturing plants that existed in the state in 1991, all were established after 1970, with seven of these units having been established in the northeast and three in southwest. Concentration in basic metal producing medium/large-scale factories was also found to occur in northeastern Punjab (for out of a total of 25 basic metal plants in the state, 11 were in this area). Another indication of new medium/large-scale factories favouring sites in northeast Punjab was found in the fact that out of a total of 17 electric machinery manufacturing plants in the state, 15 were set-up in this region over the 1970-1990 period (Punjab Directorate of Industries, 1991). However, this shift did not affect all sectors, for the manufacturing of wool and silk, leather, rubber, metal products and transport equipment continued to be concentrated in the traditional industrial core of central Punjab.

Overall, therefore, while the central Punjab districts of Amritsar, Jalandhar and Ludhiana are places in which manufacturing activity has long been concentrated, in both northeastern Punjab and in districts in the southwest, we see notable recent increments in the level of manufacturing activity. This has resulted in a clear diversification in the geography of industrial output within the state. A critical question is why these patterns of concentration and diversification happened in these particular areas. In addition, in the context of this study, we should ask whether diversification was in any way associated with agricultural activities. The literature on manufacturing activity in the Punjab provides no indication that the concentration of manufacturing undertakings in central Punjab was associated with local farm activities. Indeed, this concentration appeared well before the mid-1960s, when the Green Revolution started. Thus, the report Small Scale Engineering Industries in the Punjab: Economic and Labour Conditions showed that in 1959 the major share of manufacturing activity in the state was confined to Amritsar, Jalandhar and Ludhiana districts (International Labour Office, 1961). Providing further evidence of the enduring nature of these industrial areas, according to a number of analysts, there appears to be no fundamental reason, except for proximity to similar producers, for the concentration of manufacturing plants in Ludhiana, Jalandhar and Amritsar; although the locational advantages of being on the National Highway, along with good railway links to the national market through Delhi, are a help (Garg, 1981; Sandhu and Singh, 1981; Sharma, 1981; Gosal and Krishan, 1984; Kainth and Bawa, 1985).

Yet, in recent decades, the formation in the northeastern and southwestern districts of the state of new manufacturing plants for food products, paper production, and basic metals and machinery (which includes agricultural machinery except any electrical machinery) was not simply a response to free-market stimuli. Most evidently, it was linked to the important place that medium/large-scale plants had in expanding production in these regions (with government regulation being especially strong for these plants). More positively, the establishment of factories in these areas was associated with the special incentives that were provided by national and state governments for these areas (this view was argued strongly during interviews with officers at the Punjab Directorate of Industries). For instance, in 1978, Bhatinda, Hoshiarpur, Rupnagar and Sangrur were declared 'A' class backward areas for national government incentives (i.e. they qualified for capital subsidies, exemption from sales tax, a land purchase subsidy, priority with power connections, etc.; Punjab Directorate of Industries, 1977), while the sub-mountainous areas of Hoshiarpur and Rupnagar also qualified for additional special incentives from the state government (industries based on agricultural waste, such as wheat and paddy straw and husk, were the priority industries for these special incentives, which offers some insight on the sharp growth in paper production in this region; Table 5.8). Again, in the State Industrial Policy of 1987 and 1989, similar areas to those covered under the 1978 provisions were considered to be in need of special assistance (with new capital investment in manufacturing receiving a 15% capital subsidy, and having priority over power connections, etc.; Punjab Directorate of Industries, 1986, 1988). Likewise, in 1992, a 'Package of Incentives' was introduced by the state government, according to which new production units in these areas were again considered eligible for investment incentives, along with exemption from sales tax for a period of seven years (Punjab Directorate of Industries, 1992). However, not all industries qualified for such aid. According to State Industrial Policies in each of 1978, 1987 and 1989, as well as under the 'Package of Incentives' of 1992, some manufacturing sectors were not considered for these special incentives. Notably, most agro-based manufacturing plants were not eligible for these state capital subsidies, neither did they benefit from sales tax incentives (Appendix II). Most significant among these for our purposes, given the conclusions of the last chapter, was the inclusion of the rice sheller sector. This has never been considered eligible for state or national government incentives in any part of the state (yet, among agro-based manufacturing activities, rice shelling is the main industry that expanded dramatically after the mid-1960s).

From this broad review of geographical patterns of traditional concentration and newly-emergent industrialisation, general trends seem to suggest that manufacturing and farm production have developed independently, without any notable spatial connections with each other. However, a direct discussion on the geographical patterning of small and medium/large-scale agro-based manufacturing will obviously provide a clearer sight on any spatial coincidence of farm production and related manufacturing activity. To achieve direct 'input' and 'output' linkages between farm activities and agro-based manufacturing, agricultural machinery manufacturing and the processing of the four major crops of the state (wheat, paddy rice, cotton and sugar-cane) will be analysed. Along with a discussion of the distributional pattern of agro-based manufacturing activities, we will see how far dominant trends in farm production take place in areas that are distinctive for their capacity in allied agro-based manufacturing. Hence, the discussion will identify whether there is any geographical coincidence between agricultural production and agro-based manufacturing growth across districts.

Geographical Covariation in Agriculture and Agro-based Manufacturing

The analysis of covariation undertaken here is carried out for both small and medium/large-scale manufacturing plants for wheat products (flour milling, bakery, biscuits and confectionery), paddy rice shelling, cotton textiles and sugar mills. For all these, the non-availability of plant output data in prior years means that production covariation can only be considered for the decade of the 1980s, so attention in this section of the chapter focuses on whether links between production growth have persisted long after the Green Revolution began. Before turning to this, we need to pull out the main covariations identified in the previous section for the period since the Green Revolution. Of course, care is needed in noting these covariations, for while the farm data that were reported earlier in the chapter were for production, those for manufacture were only for employment or plant numbers. What this analysis shows is that after 20 years of the Green Revolution both the total cropped area and levels of manufacturing employment have increased in all areas within the state. What we now turn to is an analysis of growth by sector within manufacturing, to examine whether sectoral growth patterns were related to allied farm activities on a geographical basis, or if these occurred largely independently of one another.

Farm 'Output' Activities and Manufacturing Plants

Wheat and Wheat Products Manufacturing Wheat processing includes flour milling and bakery products like bread, biscuits and confectionery. These wheat products are manufactured in both small and medium/large-scale manufacturing plants. Since 1945, medium/large-scale wheat manufacturing has only existed in a few areas in the central and southwestern parts of the Punjab. Out of these, three units are in Amritsar (established in 1932, 1956 and 1972), three in Ludhiana (all set up in the 1980s), three in Patiala (created in 1944, 1946 and 1977), one in Bhatinda (1945), and one in Ferozepur (1945). For each of these districts, the largest production increase in medium/large-scale factories from 1980/81 to 1988/89 never resulted in a doubling of output (except in Ludhiana district where all factories were set-up in the 1980s). Indeed, for flour milling and bakery products the main trend in medium/large-scale plants across these districts was one of output decline or only marginal increase. Only two districts of the central region (Ludhiana and Patiala) recorded a production rise in the 1980s, while most districts experienced production losses (Table 5.9).

Table 5.9

Value of Production in Flour Milling, Bread, Biscuit and Confectionery Plants by District (in millions rupees)

Districts	Small-Scale Factories		Medium/Large-Scale Factories	
	1980/81	1989/90	1980/81	1989/90
Amritsar	6.7	30.5	103.8	112.7
Bhatinda	0.9	9.8	21.3	13.7
Faridkot	2.4	2.3	0.0	0.0
Ferozepur	0.8	2.5	20.0	16.9
Gurdaspur	0.1	3.1	0.0	0.0
Hoshiarpur	0.0	0.4	0.0	0.0
Jalandhar	0.9	11.7	0.0	0.0
Kapurthala	0.1	3.8	0.0	0.0
Ludhiana	2.6	14.6	41.9	116.3
Patiala	1.5	4.5	151.3	223.7
Rupnagar	0.0	5.8	0.0	0.0
Sangrur	0.1	3.9	0.0	0.0
Punjab	16.1	92.9	338.3	483.3

Source: Calculated from unpublished files at the Punjab Directorate of Industries.

It is true that production increases were found in all districts in small-scale manufacturing plants for each of bread, biscuits and confectionery (Table 5.9). But, for both 1980/81 and 1989/90, production levels in these plants were very small, particularly when compared to the output of large/medium-scale plants. In small-scale factories, substantial production rises were found in the central region of the state (i.e. Amritsar, Ludhiana, Jalandhar, Patiala), but production of wheat products in medium/large-scale plants was much more significant in these four districts (with total output from small-scale factories standing at 61.3 million rupees in 1989/90, compared with a figure of 223.7 million rupees for medium/large-scale factories in Patiala alone). The overall dominance of these four central region districts is clear, for in 1980/81 these had 87.8% of the state's production of medium/large-scale flour milling and bakery products, with this figure rising to 93.7% in 1989/90.

Table 5.10

Production of Wheat by District
(000s metric tonnes)

Districts	1978/81	1988/91
Amritsar	807	1,307
Bhatinda	699	1,172
Faridkot	986	1,404
Ferozepur	993	1,506
Gurdaspur	423	641
Hoshiarpur	327	459
Jalandhar	601	813
Kapurthala	274	415
Ludhiana	880	1,121
Patiala	842	1,287
Rupnagar	166	255
Sangrur	1,028	1,625
Punjab	8,026	12,005

Source: Punjab Economic Adviser to the Government, Statistical Abstract of Punjab (annual).

Although, substantial increases in farm wheat output were also found in the central region (i.e. Amritsar, Ludhiana, Patiala), during the period from 1978/81 to 1988/91, the highest producer ranks for farm output were takenover by Faridkot and Ferozepur in southwestern Punjab, along with Sangrur (Table 5.10). Yet very little wheat processing was found in these areas, even though these districts hold important positions in farm wheat production (accounting for 37.8% of total farm output in 1988/91). Another indication that growth in farm wheat output and wheat processing were not strongly related is provided by the Sangrur district of central Punjab (adjacent to the southwest region), which was placed highest in farm wheat output in 1978/81 and 1988/91 but had negligible wheat products output from its small-scale factories and had no medium/large-scale wheat processing factory in the district.

In Chapter Four it was noted that the share of wheat product manufacturing in total manufacturing activity in the state is very low, as compared to the production share of wheat in the state's total crop output. Thus, out of 312 medium/large-scale factories in the state in 1990, only 11 were wheat product processors, and just five of these were established after the arrival of the Green Revolution. Perhaps, given the restrictions that are placed on medium/large-scale factories, we might 'blame' this on deliberate government planning. But it should be noted that the failure of wheat output increases to provoke expansion in its allied manufacturing sectors was also evident for small-scale factories, for which government regulation is much less important. Here, according to the Punjab Directorate of Industries' official sources, small-scale wheat processors undertake almost all their work for household consumption. As Patnaik (1990) has pointed out, although the Punjab has been a leading wheat producer in India, most of its farm output has been moved out of the state, without any processing, so that any benefits of value addition in manufacturing accrue to other states. This is particularly apparent in the actions of the Food Corporation of India, which exports much of the Punjab's wheat to other states (as one illustration, the state's contribution to the national wheat pool was 73% of the total in 1990 and did not fall below 75% between 1980 and 1989: Punjab Director of Agriculture, 1990). The fact that wheat was not processed within the state is readily illustrated by the index of wheat production, which increased from 1.13 in 1981 to 1.44 in 1989 (where the wheat production level in 1980 is 1.00), whereas the index of wheat consumption by medium/large-scale wheat processors in the Punjab decreased from 1.13 to 0.90 over the same period. Not surprisingly, the share of the state's wheat crop that was consumed by medium/large-scale processors in the Punjab decreased from 2.13% in 1981 to 1.33% in 1989 (calculated from unpublished files at the Punjab Directorate of Industries).

None of this means that wheat production was not promoting manufacturing expansion; merely that such effects were not occurring within the wheat processing sector in the Punjab. For instance, in a 1990 market survey by the Punjab Financial Corporation, it was found that the general trend in the past was for flour mills in the Punjab to supply wheat flour and other products to Delhi, Bombay, Haryana and Himachal Pradesh, with Delhi as a major consumer of wheat products from the Punjab. But today new flour mills have been set up in these states which purchase their wheat directly from the Food Corporation of India (rather than in processed form from the Punjab). One possible reason for this is that there has been (and still is) a 4% state purchase tax on wheat products in the Punjab, whereas there is no purchase or sales taxes in Delhi, a 3% sales tax in Haryana and only a 1% sales tax in Himachal Pradesh. Moreover, the new processing units that were set up in Haryana and Himachal Pradesh were eligible for sales tax exemptions for the first seven years of their life (Punjab Financial Corporation, 1991). These factors make flour mill products more costly if they are produced in the Punjab, and (owing to Food Corporation policies) the ready availability of Punjab wheat outside the state means that the incentive for setting up processing units within the state is less than might be imagined.

<u>Paddy Rice and Rice Milling</u> Direct processing of paddy is only undertaken by rice shellers, all of whom are registered in the small-scale manufacturing sector. As discussed in Chapter Four, all paddy farm produce that is shelled by the state's small-scale rice shellers comes through regulated markets, and there is no medium/large-scale manufacturing for rice shelling in the state. Hence, the distributional pattern of paddy processing by small-scale manufacturing plants is easy to ascertain reliably across the state. By contrast, for the other major crops, information on processing activity is either available only for medium/large-scale manufacturing or figures on processing volumes are only available for small and medium/large-scale manufacturing together. Adding up output from factories in both these sectors potentially leads to misleading results from the point of view of this study, because different agents influence the growth pattern of small enterprises, compared with medium/large-scale manufacturing plants (viz. small-scale manufacturing expansion is expected to be more spontaneous than government controlled, with the latter as a key factor of medium/large-scale manufacturing activity). All this points to rice shelling being the most appropriate sector for assessing spontaneous direct links between increases in farm produce output and agro-based manufacturing production. This also arises because the marketing of paddy rice is not solely controlled by the Food Corporation of India, with an estimated 80% of the rice crop being purchased from regulated markets directly by private factory owners (Rangi,

1989). Even amongst the remaining 20% that is procured by the Food Corporation of India, all paddy is processed in the Punjab before being transported to other states (India Food Corporation, 1992).

Table 5.11

Density of Rice Shellers by District
(paddy land hectares per rice sheller)

Districts	1979/80	1989/90
Amritsar	2,587	1,440
Bhatinda	10,000	1,156
Faridkot	1,155	873
Ferozepur	3,074	1,142
Gurdaspur	2,706	1,049
Hoshiarpur	2,000	1,686
Jalandhar	12,429	2,981
Kapurthala	1,218	783
Ludhiana	14,000	2,810
Patiala	6,061	1,145
Rupnagar	2,000	1,167
Sangrur	1,741	1,225

Source: Calculated using rice sheller data from unpublished files at the Punjab Directorate of Industries, with data on paddy land area from the Punjab Economic Adviser to the Government, Statistical Abstract of Punjab (annual).

To obtain some measure of the geographical distribution of rice shellers in the state, Table 5.11 provides information on the mean average land area devoted to paddy per rice sheller in each district. Examining how this pattern has changed over time reveals that the density of rice sheller activity rose substantially in all districts in the 1980s (i.e the cropped area per sheller fell), with the sharpest changes occurring in the Jalandhar and Ludhiana districts of central Punjab and in Bhatinda in the southwest (Table 5.11).

Table 5.12

Production of Paddy Rice and Rice Sheller Processing by District

Districts	Paddy Rice (000s metric tonnes)		Small-Scale Rice Shellers (million rupees)	
	1978/81	1988/91	1980/81	1989/90
Amritsar	393	786	90.9	229.5
Bhatinda	32	185	8.6	332.0
Faridkot	249	521	300.0	626.5
Ferozepur	450	733	285.6	1,101.0
Gurdaspur	303	455	116.7	253.3
Hoshiarpur	105	181	21.9	55.4
Jalandhar	261	522	23.1	59.9
Kapurthala	196	297	115.2	250.8
Ludhiana	374	841	25.9	507.0
Patiala	586	950	206.4	558.7
Rupnagar	54	112	30.0	65.0
Sangrur	341	1,063	290.0	966.2
Punjab	3,344	6,646	1,514.3	5,005.3

Source: Punjab Economic Adviser to the Government, Statistical Abstract of Punjab (annual) and unpublished files at the Punjab Directorate of Industries.

When we compare the growth performances of districts for rice shelling and paddy rice production over the 1980s, we find that strong direct output associations exist across all districts, with both paddy output and rice shelling production expanding side-by-side (Table 5.12). Most importantly, between 1978/81 and 1989/90, southwestern and central Punjab performed well in both paddy production and rice sheller output. For instance, the highest growth rates of paddy production were recorded in the Bhatinda district of southwestern region, which saw its output rise from 32,000 metric tonnes in 1978/81 to 185,000 tonnes in 1988/91, and its rice shelling production increased to match this from 8.6 million rupees in 1980/81 to

332.0 million in 1989/90. Nevertheless, it is the central region that provides the highest output levels for both the farming and manufacture of rice products. This region contributed 64.3% of the state's paddy production in 1978/81 and 67.1% in 1988/91. It also provided 49.6% of the total monetary value of the state's shelled rice output in 1980/81 and 51.4% in 1989/90. The lower percentage for shelled rice output here arises from the relatively poor performances of a few areas in the central region for rice shelling. Thus, while Amritsar and Jalandhar districts hold important positions in paddy production, they are much less important as areas of rice shelling (Table 5.12). By contrast, the southwestern areas of Faridkot and Ferozepur contributed more in rice sheller production (which did not fall below 34.5% of total state output by value between 1980/81 and 1989/90) than in paddy rice output (which never rose above 20.9% of paddy rice output by weight between the years 1978 and 1991). Unfortunately, the literature does not provide a clear indication of why the southwest should have an 'over-representative' of this kind. It might seem that this is an instance in which government financial assistance has a role to play, as the southwest and northeast regions received most aid for manufacturing investment. However, this explanation is not helpful for the rice sheller industry, as there were no grants available for this industry (i.e. the sector was not eligible for specific state or national government assistance).

Cotton and Cotton Textiles District production of cotton textiles in the state only takes place in medium/large-scale manufacturing units. In truth, some cotton processing is undertaken in village-level spinning and weaving units, but any assessment of the spatial growth pattern for this village-based sector is very difficult to make, due to the scarcity of information on spinning and weaving units. Since 1943, out of 26 medium/large-scale cotton textile plants in the state (of which 21 were established after 1970), 15 are found in the southwestern districts (Bhatinda, Faridkot, Ferozepur and the adjacent Sangrur district).

Both close associations and some independent geographical expansion was found to exist between farm cotton output and medium/large-scale cotton textile production across the districts. For instance, cotton crop production was concentrated within the southwestern districts (including the adjacent Sangrur district of central Punjab; Table 5.13) and these four districts had 58% of the medium/large-scale cotton textile factories of the state (except for one factory that was opened in 1957, all these factories were established after 1970). A clear geographical coincidence exists for the farm cotton crop and cotton manufacturing activities in southwestern Punjab. But doubts over a close association arise for the Sangrur district, which held the fourth position at the district level for farm cotton production, but by 1989/90 was the highest contributor to cotton textile production (all the cotton textile factories in this district were set up after 1981, without any increase in cotton production in the district after that date). This weak geographical association extended into northeastern Punjab (particularly for Hoshiarpur and Rupnagar districts). Thus, the Hoshiarpur district has an insignificant level of farm cotton production, but it has become the third most important district in the state for cotton textile production, with its 1989/90 output standing at 1,189.5 million rupees (here all factories were established after 1975). According to sources in the Punjab Directorate of Industries, the primary reason for this pattern is that medium/large-scale factories were induced to locate in this district by attractive government financial incentives and by infrastructure provision.

Table 5.13

Production of Cotton and Cotton Textiles by District

Districts	Cotton (000s metric tonnes)		Cotton Textiles (million rupees)	
	1978/81	1988/91	1980/81	1989/90
Amritsar	2	0	26.0	282.8
Bhatinda	74	152	70.6	500.9
Faridkot	66	133	113.9	584.8
Ferozepur	28	80	143.0	897.8
Gurdaspur	0	0	0.0	0.0
Hoshiarpur	1	1	195.6	1,189.5
Jalandhar	1	0	0.0	8.5
Kapurthala	0	0	320.5	885.1
Ludhiana	6	6	397.6	1,280.8
Patiala	4	1	135.1	487.5
Rupnagar	0	0	45.9	98.4
Sangrur	29	25	26.6	1,399.7
Punjab	211	398	1,474.8	7,615.8

Source: Punjab Economic Adviser to the Government, Statistical Abstract of Punjab (annual) and unpublished files at the Punjab Directorate of Industries.

The key point is that the chance of locally-initiated agriculture-manufacturing linkages for cotton production are slight for the Punjab. The main reason for this is that more than 50% of medium/large-scale factories are directly controlled by the National Cotton Corporation, with this institution also acting as the dominant buyer of the cotton crop in the regulated markets of the state (and this Corporation can take its purchased produce to any of its manufacturing plants in India). So decisions on manufactured output are made by the National Corporation rather than by individuals whose decisions are free from government direction (who might establish a factory in locations where they find raw materials are readily available). Rather than adopting an investment strategy that is locally-oriented in this way, the National

Corporation adopts a locational strategy that relies more on national decision criteria. This process is illustrated by the two new cotton mills that the Corporation has established in Gujarat state. This state was selected, not for its cotton supplies, for these plants receive the cotton they process from the Punjab, but because of the quality of local port facilities, which were seen to be advantageous for national exports (Punjabi Tribune, 30th November, 1992, p3).

Sugar-cane and Sugar Mills After home consumption, sugar-cane processing was only undertaken in medium/large-scale sugar-cane mills in the state. Out of all 17 sugar mills in the state (12 were established after the mid-1960s), 11 were in central Punjab and three in northern Punjab (i.e. Gurdaspur district). In 1980/81, output from these sugar mills was highest in Gurdaspur and Jalandhar, with values of 124.8 million and 87.3 million rupees, respectively. But after 1980/81, a few districts increased their share of total sugar mill production in significant ways. Most notably, sugar mills in Amritsar and Ludhiana only began production after 1985, but by 1989/90 they contributed 138.4 and 253.1 million rupees to the state's total output. Revealing a similar pattern of rapid output growth, production in Kapurthala increased from 20.8 million rupees in 1980/81 to 385.1 million in 1989/90 (Table 5.14).

A geographical coincidence in the output of sugar-cane from farms and in processing activity in medium/large-scale sugar mills was only found to exist in the central Punjab district of Jalandhar and in Gurdaspur in the northeast. Both districts hold the highest ranks for sugar-cane and sugar mill output at the beginning and at the end of the 1980s (Table 5.14). Apart from this coincidence, the pattern of output change in agriculture and manufacturing did not covary in significant ways. Thus, in a few areas (like

Amritsar and Sangrur), sugar-cane production on farms decreased at the same time as districts saw increased sugar mill output. In other areas (such as Hoshiarpur) increased sugar-cane production was accompanied by none of the state's sugar mills being found in a district, or, as a converse trend, by low rates of sugar-cane output being accompanied by sharp rises in the volume of sugar processing within the district (as for Kapurthala).

Table 5.14

Production of Sugar-cane and Sugar Mill Output by District

Districts	Sugar-cane (000s metric tonnes)		Sugar Mills (million rupees)	
	1978/81	1988/91	1980/81	1989/90
Amritsar	38	30	0.0	138.4
Bhatinda	10	9	0.0	0.0
Faridkot	7	11	0.0	0.0
Ferozepur	15	40	4.4	187.7
Gurdaspur	86	110	124.8	233.7
Hoshiarpur	32	77	0.0	0.0
Jalandhar	71	151	87.3	352.6
Kapurthala	14	20	20.8	385.1
Ludhiana	31	46	0.0	253.1
Patiala	43	51	0.0	111.8
Rupnagar	61	72	50.2	130.7
Sangrur	47	30	23.8	154.2
Punjab	455	647	311.3	1,947.3

Source: Punjab Economic Adviser to the Government, Statistical Abstract of Punjab (annual) and unpublished files at the Punjab Directorate of Industries.

How can we to explain these contradictory trends? Fundamentally we can note that most of the medium/large-scale sugar mills were controlled by the Punjab State Co-operative Sugar Mills Federation Ltd., so decisions concerning the production and location of mills were made by one organisation (as well as being subject to approval by the national government; Singh, 1992). In interviews at the head office of this organisation it was ascertained that a sugar-cane catchment area is drawn around each mill by a government appointed Cane Commissioner. Factories are expected to take steps to improve the sugar-cane crop within that area, by providing special incentives to enter this production sector to local farmers (including offering seeds, pesticides, etc.). Farm production within the catchment area of a sugar mill is then bought directly by the mill. If the mill wants to purchase sugar-cane from another area, permission must be obtained from the Cane Commissioner (Singh, 1990). It is clear that on the manufacturing side, sugar-cane processing is tightly controlled. In terms of expecting farm production to directly promote or encourage manufacturing expansion, government control dampens such tendencies.

Farm 'Input' Activities and Manufacturing Plants

When considering the potential for growth-linkages between agriculture and manufacturing on the farm input side, we should acknowledge that agricultural machinery has more effective potential links to local agriculture than other farm inputs, like fertilizers and seeds. A key reason for this is that the distribution of fertilizer all over India is controlled by the national government (i.e. by the Fertilizer Association of India). In effect, native fertilizer manufacturing plants are the monopoly of the government. All arrangements for their raw materials and finance are arranged through the Fertilizer Association of India. The allocation of fertilizer to a state is decided by the national government, with quality control and distribution within the Punjab technically being controlled by the Punjab Department of Agriculture (in fact, in the Punjab the distribution is devolved in a controlled manner to the Punjab State Co-operative Supply and Marketing Federation, to the Punjab Agro Industries Corporation and to private dealers). As for seeds, here analysis is made difficult by the fact that farmers mainly accumulate seeds from their own farm produce (Rangi, 1990). If new variety seeds are needed, or are being promoted, these almost always come from National Seed Corporation, and are mainly distributed by the Punjab Agricultural University (Chopra, 1986).

Agricultural machinery manufacturing in the state was undertaken in both small and medium/large-scale plants. But the distributional pattern was found to be somewhat different for these two size categories. Most notably, small-scale farm implements manufacturing was spread across all districts in the state (Table 5.15), whereas medium/large-scale manufacturing was concentrated within a few areas. The medium/large-scale agricultural machinery manufacturing was mainly located in the Rupnagar district in northeastern Punjab. In truth, out of a total of five medium/large-scale agricultural machinery manufacturing plants in the state, only two were located in this district, but these two accounted for 97.3% of the value of machinery production undertaken in medium/large-scale plants in 1980/81 and for 96.1% of output in 1989/90. Both of these factories were established after 1970, but according to officials at the head offices of these factories in Chandigarh, these two government-owned factories were located here in response to the government's policy of promoting medium/large-scale manufacturing expansion in the north of the state, rather than arising as a response to local farm demand.

On the other side, similar to what has happened for the state's overall farm output, the development of small-scale plants has occurred in each district, which raises the possibility that these plants were set-up in

Table 5.15

Density and Production of Small-Scale Agricultural Machinery Plants by District

Districts	Cropped Area Per Manufacturing Plant (hectares)		Production (million rupees)	
	1979/80	1989/90	1980/81	1989/90
Amritsar	4,353	991	14.7	69.3
Bhatinda	4,392	1,594	7.2	72.6
Faridkot	1,651	1,012	37.6	94.1
Ferozepur	2,913	1,699	14.6	125.5
Gurdaspur	1,973	763	15.9	42.1
Hoshiarpur	2,513	1,305	1.6	9.3
Jalandhar	1,431	777	51.6	158.3
Kapurthala	2,918	992	11.9	37.2
Ludhiana	1,839	944	60.2	151.0
Patiala	3,610	1,400	11.1	54.1
Rupnagar	1,581	432	18.0	55.2
Sangrur	1,831	942	15.0	52.3

Source: Calculated using agricultural machinery units data from unpublished files at the Punjab Directorate of Industries, with data on cropped area from the Punjab Economic Adviser to the Government, Statistical Abstract of Punjab (annual).

response to local farm demand. One indication of direct growth relations between small-scale farm implements plants and farm activities is that the production share of small-scale units in all regions is fairly evenly matched with the share of the total cropped area in the state on a district-by-district basis. For instance, the production shares of small-scale machinery plants in the central, southwestern and northeastern regions in 1980/81 were 63.4%, 22.9% and 13.7%, with figures of 56.7%, 31.7% and 11.6% for 1989/90, respectively. These figures compare with similar percentage shares for the total cropped area in these regions, for which the proportions of the state total in 1978/81 were 50.0%, 35.1% and 14.9%, with figures of 50.1%, 35.6% and

14.3% for 1988/91, so providing a particularly close fit with the distributional load of small-scale machinery output.

Conclusion

The spatial investigation of the agricultural sector reveals that, with the arrival of the Green Revolution, the total cropped area increased across all districts. Yet the benefits of high output growth in wheat, paddy rice, cotton and sugar-cane were not shared equally but made their presence felt in different parts of the state. Only wheat output improved relatively consistently across the northeastern, central and southwestern regions of the Punjab. By contrast, enhancements in paddy output were focused more in the districts of Ludhiana, Sangrur, Jalandhar and Patiala in central Punjab, as well as in Faridkot, Ferozepur and Bhatinda in southwestern Punjab. Cotton production improvements were concentrated in southwestern Punjab alone, while sugar-cane output improved in the Jalandhar and Kapurthala districts of central Punjab and in all parts of northeastern Punjab.

On the agro-based manufacturing side, wheat processing occurred across the state in small-scale manufacturing plants, but these provided little of total processed output. This was primarily a product of medium/large-scale manufacturing plants that were located in the Patiala, Kapurthala and Amritsar districts of central Punjab. For rice shelling, on the other hand, small-scale production was dominant. Here, small-scale units were found in most of the areas where paddy production had grown significantly (e.g. Ludhiana, Sangrur and Patiala in central Punjab, as well as in Faridkot, Ferozepur and Bhatinda in southwestern Punjab). Even here though, there were exceptions, for the Amritsar and Jalandhar districts hold an important place in paddy production but increases in their rice shelling output were comparatively modest. Even so, there was a stronger pattern of consistency in output growth for rice processing than for any other farm crop. This is despite the fact that, for cotton processing, the highest manufactured output rises did occur in the areas that made the most substantial contribution to the state's output of cotton from farms (viz. in southwestern Punjab). However, this picture of close association for cotton was contradicted by events in central Punjab, where areas had substantial cotton textile output without having an important position in farm cotton production (e.g. the districts of Kapurthala, Ludhiana and Patiala). A similar pattern was found for sugar-cane mills, which were found to exist in areas with high sugar-cane production (as for Jalandhar in central Punjab and Gurdaspur in northeastern Punjab), but where significant sugar-cane improvements were found for areas with no sugar mill (e.g. Hoshiarpur), while in Sangrur decreases in sugar-cane production were aligned with increased sugar mill output.

Patterns of geographical coincidence in production growth between farming and manufacturing suggest that few direct output linkages exist for agro-based manufacturing. Manufacturing activities were spread over areas without notable agricultural improvements, and some areas of agricultural development were not participants in general trends of improvement in agro-based manufacturing. Certainly, the analyses of agriculture-manufacturing output linkages undertaken here do not provide a clear sight of a geographical foundation for strong sectoral interaction, even if there might be some room for doubt due to the unavailability of information on the final destination of all farm produce. Of the farm products examined, paddy rice is the only crop for which increases in farm produce can be said to reveal a direct geographical coincidence between farm output and the activities of rice shellers. Perhaps this pattern would be more generally observed, if the sale of farm commodities operated more closely to the ideal of a free-market (after all the sale of paddy rice is the only one of the four crops investigated that could be sold in anything like a free-market situation). Certainly, this pattern of close association between farm output and manufacturing activity was also found for the distribution of small-scale agricultural machinery manufacturing and for measures of general farm activity (viz. the total cropped area). However, data limitations have meant that it has not been possible to confirm that such linkages existed in the Punjab earlier than the 1980s. Anyhow, the mere fact of a geographical coincidence of production does not tell us whether in reality (say) rice shellers buy their raw materials locally within the state or if improvement in the rice sheller industry was directly associated with local farm activities, nor does it directly tell us that manufacturers of agricultural machinery sell their products to farmers in the state. Hence, to provide real insight on the strength of direct growth linkages, a questionnaire survey was carried out. The results from this investigation are presented in Chapter Six.

Chapter 6

Production Changes in Manufacturing Plants: Rice Shellers and Agricultural Machinery

What distinguishes the evaluation of agriculture-manufacturing linkages that is presented in this chapter from the assessments in the last two chapters is that its data base focuses on individual decision-makers. In providing an analysis of agriculture-manufacturing linkages at the level of decision-making units, the researcher is faced with two possibilities. On the one hand attention could focus on farmers, with the intention of identifying the extent to which farm output has been directed towards manufacturing plants, assessing whether production levels are in any way affected by demand from manufacturers, and examining how far farm production is supported by or even changed as a result of the usage of manufactured inputs in farm production processes. On the other hand, the researcher can centre attention on manufacturing plants, to see how far their output, and changes to that output, is influenced either by the supply of farm produced material or by demand for manufactured products from the farming sector.

In reality, in the Punjab it is extremely complicated to concentrate on farmers, if the intention is to investigate the distributional pattern of farm inputs and outputs in order to assess the extent to which they have had an impact on local manufacturing plants. A primary reason for this is that farmers sell much of their produce to commission agents or government procurement agencies, as well as buying many of their farm inputs through retailers and co-operatives. This means that if we are to evaluate whether farm supplies did come from local manufacturers (or farm produce went to local industrialists), a multiple stage interview process would be required. On the farm produce side, the complexity of the various stages that can come between farm sellers and manufacturer buyers arises because commission agents are free to sell the produce they buy all over India, while government agencies can allocate materials to any part of the nation. Potentially, a Punjab commission agent could sell farm produce to another agent outside the Punjab who, for whatever reason, then sells the produce to a Punjab manufacturer. Even longer chains usually exist for farm input supplies. As a result, if we wished to trace the real origin of farm inputs we might have to start with retailers, go back to their wholesale suppliers, then investigate their distributors and the manufacturers from whom they obtained their products. This chain could end abruptly in the Punjab or, after a variety of steps outside the state, could lead to the point of initial production being a Punjabi manufacturer, or it might include various transactions within the state with the production point being elsewhere. Whichever is the case, the idea of tracing Punjabi rice to see if it is used in Punjabi manufacturing reaches new heights of difficulty when commission agents mix Punjabi farm produce with that from other states. The overall complexity of such an evaluation, and the workload required in undertaking it, thereby makes a farm centred investigation inappropriate for a study such as this one.

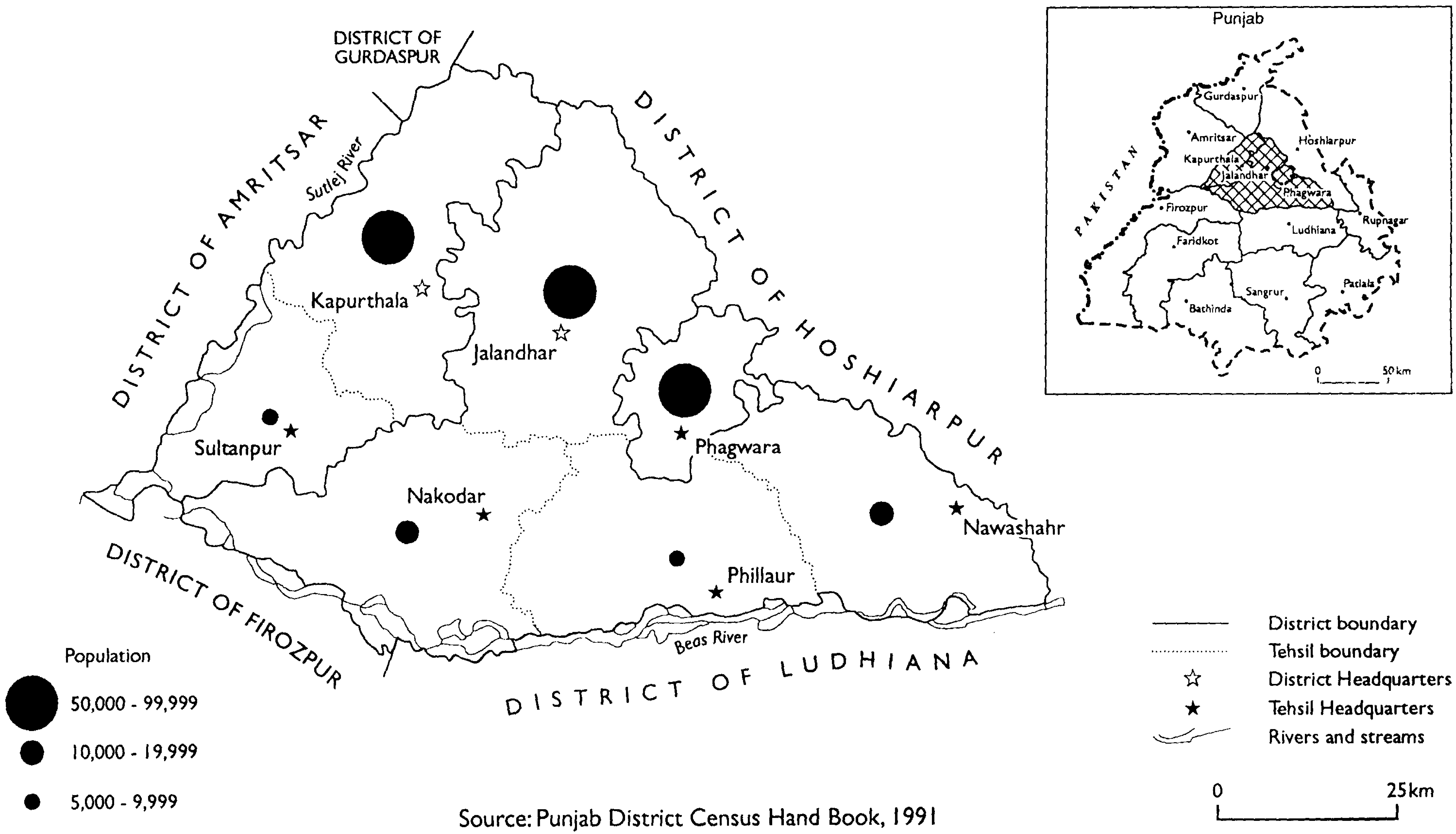
The approach adopted therefore was to question manufacturers about their input purchases and about the destinations of their outputs. The main focus in data collection was on whether manufacturers responded to the opportunities afforded by increased farm output within the state. This was done by establishing the extent to which inputs into farming came from Punjab manufacturers and how far agro-processing activity relied on farm produce from within the state. To achieve this, two surveys were conducted. The first survey was of rice shellers, which is an agro-processing industry allied to one of the main farm products of the state. As the analysis in Chapter Four and Chapter Five have shown, since the mid-1960s improvement in paddy crop output within the state has been substantial, and it has been accompanied by major expansion in the number of rice shellers, so that within their respective economic sectors of farming and agro-manufacturing both are now key production areas in the state. Indeed, when viewed either in terms of temporal production change at the state level (Chapter Four) or in the context of geographical distributions (Chapter Five), the evidence examined so far points to paddy rice production as having the strongest links with manufacturing expansion of any of the main farm products of the state. But what Chapter Four and Chapter Five could not assess is how decisions about growth in one of agricultural or manufacturing were causally linked to expansion in the other. All these chapters showed were patterns of temporal and geographical covariation. By inquiring directly from manufacturers, this chapter seeks to examine explicitly the nature of any causal connections. The second survey was of agricultural machinery manufacturers, which were taken to be representative of those industries that provide inputs into farm production. Chapter Five showed that compared with other agricultural inputs, like fertilizers and seeds, agricultural machinery was the sector in which there was likely to be the most direct agriculture-manufacturing links. Selection of this sector was also appropriate because it incorporates manufacturing activity that supplies all types of farming. Even if improved farm output in one crop does not provoke growth in manufacturing to process that specific crop, this does not mean that farm output expansion has not assisted manufacturing growth, for this could have been achieved through higher rates of utilisation of manufactured farm inputs. In examining agricultural machinery producers, this chapter seeks to assess whether this is the case and what is the direction of causation.

In selecting these two sectors a further crucial consideration in their selection was the size structure of industrial units, for both the rice-shelling and the agricultural machinery sectors are dominated by small-scale producers. The importance of this stipulation was indicated in earlier chapters. It arises because small-scale manufacturing plants are subject to less government direction than their medium/large-scale equivalents, which are highly directed and controlled by government regulation. As such, the expansion of small-scale manufacturing plants is more able to be spontaneous, rather than relying on government plans and decisions (especially as low levels of regulation and relatively low costs make entry into a sector much easier for small-scale plants, where owners have more freedom in decision-making). It follows that small-scale manufacturing plants are better placed to expand (or contract) production as an 'immediate' response to changes in the agricultural economy of their local area (even so, in order to provide a comprehensive picture of these sectors, analysis was not restricted to small-scale producers, for those medium/large-scale manufacturing units that did exist in these sectors within the survey areas were included in the questionnaire surveys undertaken). As such, a survey of small-scale manufacturing units is an appropriate means of directly assessing agriculture-manufacturing linkages.

During 1989/90 (the latest information available prior to the questionnaire survey that was undertaken), there were 1,550 rice shellers and 7,136 small-scale agricultural machinery plants in the state (unpublished files, Punjab Directorate of Industries). With so large a number of manufacturing plants, the cost and time required to undertake a state-wide survey was prohibitive and led to interviews being based on selected geographical areas (Figure 6.1). In terms of sample design, a multi-stage stratified sampling procedure was used, in which district and tehsil were the first units to be selected (a tehsil is a sub-division of a district for administrative and land revenue purposes), with manufacturing plants chosen at the second stage. Administratively, the Punjab is divided into 12 districts and 48 tehsils. Out of these geographical units, areas were selected in terms of their comparative advantage for both the rice shelling industry (which describe agricultural 'output' linkages) and agricultural machinery manufacturing (which reveal 'input' linkages with agriculture). Owing to data availability, along with the types of manufacturing plant in each production sector, plus variation in the number of plants in each tehsil or district, slightly different geographical zones were selected for the examination of 'output' and 'input' linkages. For rice shellers, Jalandhar and Kapurthala <u>tehsils</u> were the focus of the interview work, whereas the need to construct a broader analytical framework for data collection from agricultural machinery manufacturing plants meant that the <u>districts</u> of Jalandhar and Kapurthala were selected. These study areas are felt to be representative of the state in terms of the distinctive characteristics of the rice shelling industry and of agricultural machinery manufacturing. In order to illustrate this point, before undertaking an assessment of causal patterns in the 'output' and 'input' linkages of manufacturing plants, a commentary will first be provided to justify the choice of study area for the questionnaire surveys undertaken.

Figure 6.1

Jalandhar and Kapurthala Districts



Source: Punjab District Census Hand Book, 1991

'Output' Linkages with Rice Shellers

Before describing the process of survey area selection, it is necessary to clarify for readers who are not familiar with the Punjab that Jalandhar district is comprised of four tehsils, with one of these being the tehsil of Jalandhar (i.e. the four tehsils in Jalandhar district are Jalandhar, Nakodar, Nawan Shahar and Phillaur). A similar situation exists in Kapurthala district, where the three tehsils of this district are Kapurthala, Phagwara and Sultanpur. When selecting the areas to be focused on in this study, the intention was to use the finest grained geographical division, which meant that, for much data, selection could be based on tehsils. However, in some cases, where data are not available for tehsils, both the comparison of areas had to made, and the selection of areas had to be justified, on a district basis. In the appraisal that was undertaken for the rice shelling industry, the choice of geographical areas was based on the characteristics of both agricultural and manufacturing activities. This led to a coding of places that distinguished: (a) the comparative dominance of the land area under paddy rice compared with the number of rice shellers in each district (data on the number of rice shellers were not available at tehsil level), which ascertained the density of rice shellers across districts (for which data on rice shellers were only available at the district level in unpublished files at the Punjab Directorate of Industries, with data on the land area under paddy taken from the Punjab Economic Adviser to the Government, Statistical Abstract of Punjab, 1990); (b) the relative importance of paddy rice production within tehsils, as determined by the percentage of the total cropped area in a tehsil that was cultivated for paddy rice (for which data were available in the Punjab Economic Adviser to the Government, District Statistical Hand Book, 1989 for Jalandhar and

Kapurthala; and, (c) the incidence of medium/large-scale rice bran oil manufacturing factories, so that areas could be identified with different degrees of 'large' factory activity. (Rice bran oil is made with polish which is removed from rice during the shelling operation. Hence, rice bran oil production in medium/large-scale producing units actually depends upon raw material supplies from rice shellers. Information on rice bran oil production came from unpublished files at the Punjab Directorate of Industries).

Examining each of these in turn, the comparative magnitude of the cropped area under paddy and the number of rice shellers in a district were considered first in order to identify variations in production activity. This analysis indicated that the highest geographical concentration of rice shellers in any district was in Kapurthala, with Jalandhar positioned as the district with the lowest density of rice shellers in the state (Table 6.1). A comparative match in the density of rice shellers was found for the district of Faridkot with that of Kapurthala and for Ludhiana with Jalandhar (having 873 and 783 hectares per rice sheller, and 2,810 and 2,981 hectares, respectively), but the locational proximity of Jalandhar and Kapurthala districts was an additional reason for choosing these areas, as this obviously economised on travelling cost and time. This was an important consideration, for during the survey period political disturbances were common in the state. This usually meant that public transport stopped running after 1800 hours each evening. Curfew restrictions were common and periodically they were clamped down suddenly, sometimes for 24 hour periods, and frequently from early evening until the next morning. With special identity cards being required for any travel or even for movement out of the house, the overall atmosphere was not one in which unnecessary travel was advisable (see Appendix III). In truth, however, the political situation in the state was not the main reason for choosing the study areas (although their proximity to one another did matter), for the key criteria for selection were always the economic conditions in districts and tehsils. In selecting Jalandhar and Kapurthala, districts were chosen that were at the top and the bottom of the scale of rice sheller density, so these two districts provided coverage of the breadth of rice shelling activity within the state.

Table 6.1

Paddy Rice Cropped Area and Number of Rice Shellers by District - 1989/90

District	Paddy Rice Area (000s ha)	Number of Rice Shellers	Hectares per Rice Sheller
Amritsar	278	193	1,440
Bhatinda	52	45	1,156
Faridkot	138	158	873
Ferozepur	225	197	1,142
Gurdaspur	171	163	1,049
Hoshiarpur	59	35	1,686
Jalandhar	155	52	2,981
Kapurthala	94	120	783
Ludhiana	222	79	2,810
Patiala	277	242	1,145
Rupnagar	35	30	1,167
Sangrur	283	231	1,225

Source: Punjab Economic Adviser to the Government, Statistical Abstract of Punjab (1990) and unpublished files at the Punjab Directorate of Industries.

The second criterion that was used in the selection of study areas was based on tehsil level information. As compared to the state average for the percentage of all farm land given over to rice paddy production in 1987, the Kapurthala tehsil had one of the highest percentages, while the Jalandhar tehsil had one of the lowest percentages (these data are taken from Punjab Economic Adviser to the Government, District Statistical Hand Book, 1989). Although many other tehsils were positioned similarly to

Kapurthala and Jalandhar according to this criterion, the Kapurthala tehsil had the additional advantage of having a clustering of medium/large-scale rice bran processing plants (the third criterion used in district selection), with only one factory of this type and size in the Jalandhar tehsil. As rice bran processing is directly related to the rice sheller industry, it was thought appropriate to include areas of rice bran oil production in case the incidence of rice shelling activity arose less from the potentialities afforded by the farm sector and more by the prospect of generating inputs for rice bran oil factories.

Using the above combination of information for both districts and tehsils, the tehsils of Jalandhar and Kapurthala were chosen for the questionnaire survey of rice shellers in this investigation. Information that became available just prior to the survey from unpublished files in district offices showed that the density of rice shellers in these tehsils was a reflection of the pattern that obtained at the district level (so the density of rice shellers in Kapurthala tehsil was nearly three times greater than in Jalandhar). This tehsil level information was only available by making personal visits to district headquarters, so the utilisation of tehsil data on rice sheller density over the whole state was not a feasible option for study area selection. Nevertheless, on gaining access to these data, it was important to be able to confirm that the study areas selected did occupy positions that would place them towards the top and the bottom of a rank order of places in the Punjab, for this provided contrasting conditions that cover some of the variety of circumstances within the state. In all, figures from the district office of the Punjab Food and Supply Department showed that at the time of the survey 17 rice shellers existed in Jalandhar tehsil while 65 were to be found in Kapurthala tehsil. If these figures are compared to the area of land under cropped paddy in 1987 (the latest available information at the tehsil level), when Jalandhar and Kapurthala tehsils had 37,500 and 49,100 hectares, respectively, then Jalandhar had 2,206 hectares of paddy per rice sheller whereas Kapurthala had 755 hectares per sheller. All rice shellers in these two tehsils were approached and asked to complete a questionnaire. There was a 100% response rate. Significantly, the information derived from these rice shellers not only provides a comprehensive picture of this manufacturing sector today, but in many respects can be taken to represent the sector as far back as the introduction of Green Revolution technologies in the mid-1960s. The reason why this is so is because records at the district offices of the Punjab Food and Supply Department show that since the 1960s only three buildings that previously housed sheller plants had ceased to operate within these tehsils.

The Rice Shelling Industry in Jalandhar and Kapurthala Tehsils

The questionnaire that was used to evaluate 'output' linkages between farm and rice sheller activities was designed to obtain information on the extent to which production growth in the industry was directly affected by local agricultural activities (a copy of the questionnaire used is provided as Appendix IV). The first key issue for the questionnaire was the year of establishment of existing plants, which is an important consideration given that, as Chapter Five showed across all districts, paddy crop output only increased in a notable manner after the mid-1960s. As a result, given few losses from the population of rice shellers since the 1960s, the date at which plants started operations provides a useful indication of the likelihood that plants began production in response to increases in paddy rice output. Of course, temporal coincidence is not a sufficient measure of causal connection, so this analysis will be followed by looking at the reasons why manufacturers entered the rice shelling sector, to see if this was in response to growth in agricultural production. As part of the attention given to the reasons for establishing a plant, questions were also asked about the decision to set-up a factory in a particular location, as well as on any changes in the volume of production, or in the type of raw material used, once the plant was established. In both cases the primary issue was whether the availability of local farm output supplies was a critical factor in manufacturers' decisions. Questions were also asked about the source of finance for the building or purchase of a plant, and for the funding of any production expansion that has occurred within the plant, as it was pertinent to establish whether plants started or selected their location in response to government funding or responded simply to market conditions. Furthermore, questions were asked about the source of raw material purchases for plants, in order to check whether it was local farm produce that was being used by rice shellers.

Before turning to these indices of agriculture-manufacturing linkages, it is important to mention that decision-making within the rice sheller industry, whether this was concerned with starting a factory, site selection, raw material purchases, or changes to the factory's line of finished products, depended upon the entrepreneurs' own choices. Thus, the survey results indicate that all rice shellers were in the private sector, with 21.2% of factories operated by a single owner and 78.8% owned by a two or three person partnership (analysis of the decisions made by firms indicated that these were not affected by plants having a different number of owners). The survey results also reveal that the growth pattern of rice shelling plants was not influenced by the size of factories, which is a notable result given that there was some variety in factory size (in all, 26.3% of the factories had less than 25 workers, 36.3% had from 26 to 50 employees, 27.5% had between 51 and 100 workers, and 10.0% had more than 100 employees).

Factory Growth One measure of the agrarian impact on manufacturing expansion is the substantial development of the rice shelling industry that occurred after the mid-1960s. Data from the questionnaire survey confirm the strength of this growth by revealing that 92.5% of rice shelling enterprises were formed after 1969, although only 31.2% were set-up between 1970 to 1980, while 61.3% were created after 1980 (hence only 7.5% of rice shellers existed before 1970, of which just 3.7% of plants started their operations before 1966). Patterns of farm produce showed a similar growth status to manufacturing over this time period. For instance, the two survey areas only produced 65,000 metric tons of paddy rice in 1967/71, but this increased to 457,000 in 1978/81 and to 819,000 metric tons for 1988/91. The first rice shelling plant in my survey area started production in 1961, and those shellers which were established between 1961 to 1969 were all in Kapurthala tehsil, where some cropland was under the rice paddy crop even prior to the Green Revolution. In reality, then, the big spur for the rice sheller industry only occurred a few years after the arrival of new high-yielding paddy crop varieties. As a result, in my survey analysis, I examine differences in rice sheller activity largely by comparing those plants established before 1970 and those started after 1970. Significantly, at the time production started, no factory moved in from another part of the state or from a place elsewhere in India. All the factories that were surveyed started their production activities at their present location.

The extent to which the growth of this manufacturing activity was associated with local farm activities was assessed by asking the reasons for the construction of a new plant or the purchase of an old unit for starting this business. In addition, a question was asked on what activity took place in an old building before the present factory started production, assuming the factory was not newly built. This additional question was asked to see if rice processing replaced another form of manufacturing or if a new processing capacity was being created which contributed to the state's small-scale manufacturing base. Analysis of the responses to this question revealed that 60% of factories were newly built, while 40% of manufacturers bought an existing building for their rice shelling activities (whether or not factories were in new or existing buildings was not related to when rice shelling began over the 1961-1991 period). When reasons for building a new factory were examined, four-fifths of new factory operators replied that a building that was suitable for the rice shelling activity that they planned was not available. For instance, one entrepreneur commented: 'Rice shelling building has itself peculiar construction, no other small-scale manufacturing require huge building with very little machinery in it'. As an additional consideration, those who built their new factory between 1984 to 1991 all replied that the expected profitability of this business sector meant that a new ready-made building could be easily justified economically (as an example, one sheller set-up a unit in 1991 just because he had a sheller operation before and the profit from his previous unit gave him enough cash surplus to establish another one). In fact, many entrepreneurs expressed the same sentiment as one owner who stated that: 'When sheller owners showed off their profitability, others followed like a rat race'. As for the 40% of plant owners who bought an old building, only two units were active production facilities (both as groundnut oil making mills), which were replaced by rice shelling. The rest of the buildings were already used for rice shelling, with more than half (22.5% of all the present rice shellers) starting their establishment in a building that was sold due to the collapse of a prior rice sheller partnership. A further one-quarter of those who bought an old building said that their building originally belonged to farmers who had used the property for rice shelling but had moved out of this activity and now rented out the premises to other operators in the rice shelling sector. According to one lease-holder: 'Running a business is not a farmer's cup of tea. Punjabi farmers can only grow crops'. For these lease-holders the norm is for rents to be paid one year in advance. However, another group of lease-holders were drawn into renting a property, rather than building a new factory, because old building units were available on easy payment instalments (in these cases some people had just built new buildings but they were not operating them as manufacturing plants mainly because having started an operation in this sector they found they did not have the management skills or orientation to work in this sector, so they decided to rent out the building they had constructed). The data also indicates that since production by the present operators began, all buildings (either newly built or already established) have been devoted to rice shelling activities alone.

Extending the analysis of the start of rice sheller production, an examination was made to find out the reasons why a rice shelling factory was set-up at all. The key issue here was whether factories were set-up due to the availability of agricultural raw materials or if other factors were more important in their establishment. Critically, since this manufacturing sector obviously relies on farm output for its raw materials, the issue that needs clarifying is whether access to agricultural raw materials was the prime factor in promoting new rice shelling activity, or if the rice shelling industry expanded first and then encouraged farmers to grow more paddy. The answer to this question is that all rice shellers confirmed that they had set-up their factory because paddy rice was available in abundance. The potential profitability from engaging in manufacturing in the rice shelling industry was confirmed by 87.6% of sheller owners who gave this as a second important reason for entering this sector, with this factor being slightly more important for entrepreneurs who started their business after 1980, as well as for those who bought old buildings. In addition, 91.4% of entrepreneurs admitted that a third important factor behind decisions to start a rice sheller operation in Kapurthala tehsil was because it was a well-known rice shelling area in the state. Illustrative of many plant owner views, one remarked: 'Anybody can judge the importance of paddy and rice shelling activities in Kapurthala, by noticing that the Punjab's only one Rice Research Centre was set-up in this smallest district of the state'. Significantly, the survey results reveal that the reasons given both for starting a factory and for site selection were not influenced by the different size of plants.

<u>Factory Investment</u> Having confirmed that the availability of farm produce enhanced rice shelling expansion, it is important to know the source from which factory owners received the finance they needed to establish their factories. Although the sourcing of factory costs is not directly related to farm-induced growth processes, if the expansion of this manufacturing sector was due to 'spontaneous growth' in response to raw material availability then we should find that little of the cost of expansion was paid for by a multinational company or a big business house in India, nor indeed by government grants. Effectively, if the expansion of rice shelling activity was a spontaneous response to growth in farm production, then we should expect to find that the

funding for this growth came from small entrepreneurs themselves, rather than from large companies or the government. To see if this was the case, the questionnaire asked about funding sources, in terms of categories like the entrepreneur's own funds, bank loans, loans from co-operatives (agricultural or industrial), government subsidies, money from other family members, foreign remittances, etc. Out of these, the dominant investor was found to be the entrepreneur (who either invested money from personal savings or took a loan from a commercial bank). For instance, representative of comments made by most sheller owners, one mentioned that: 'The state or national government did not provide any finance for initial investment. The rice mills were mainly set-up by commission agents or well-off businessmen or by rich farmers or by those who have had political contacts with the State Directorate of Food and Civil Supplies for [i.e. who issue the] Rice Milling Permit'. The percentage of investment that came from government subsidies was always zero, no matter what year the factory was established and no matter what the size of the factory. Yet it is notable that reliance on an entrepreneur's own personal resources declined over time. Factories established before 1969 were completely financed from the funds that the owner already had (i.e. without loans), whereas this figure fell to around 30% for plants that were set-up after 1969 (Table 6.2).

Most notably this shortfall was made-up by commercial bank loans, whose share of total investment costs increased over time (Table 6.3). Perhaps surprisingly, no factory was set-up by relying on a commercial bank loan for all its costs. This compares with 35.0% of owners drawing all the costs for their rice shelling plant from their own personal resources (out of these, 6.2% of factories were set-up before 1969, 10.0% between 1970-1980 and 18.8% were established after 1980). By contrast, across all factories, 6.3% of manufacturers did not use any money from their own personal funds. Overall, however, the weight is clearly spread more toward the use of personal funds, for as well as 35.0% only using this funding source, another 32.5% paid for more than half of the total costs of their plant from their own pocket, with 26.3% investing between 10-49% of the total costs of their plants from their own financial sources. The comparable percentages for factories using bank loans were 32.5% (for more than half the funds), 25.0% (for between 10 and 49% of funds) and 42.5% (for no funds coming from a bank loan).

Table 6.2

Percentage Share of Entrepreneurs' Financial Resources in the Cost of Rice Sheller Plants

Period started	0	10-49	50-90	100
1969 or earlier	0.0	0.0	0.0	100.0
1970-80	0.0	33.3	38.1	28.6
1981 or later	10.2	26.5	32.6	30.6

There are gaps in the percentages indicated in this table as no factory owner used the omitted percentages of their own resources.

Table 6.3

Percentage Share of Factory Investment from Commercial Bank Loans in Starting a Rice Sheller Plant

Period started	0	10-49	50-90	100
1969 or earlier	100.0	0.0	0.0	0.0
1970-80	28.6	28.6	42.8	0.0
1981 or later	40.8	26.5	32.7	0.0

There are gaps in the percentages indicated in this table as no factory owner used the omitted percentages.

Apart from these two major investment sources, funds for establishing a plant came from many other sources. Government funds were available, but not as subsidies for this sector. Rather these funds came as loans, which were available occasionally at lower rates of interest than those posted by the commercial banks. For example, one owner that established his plant in 1974 obtained 75% of the required funding through a loan from the Punjab Financial Corporation, while another obtained 75% of the initial investment through a loan from the National Small Industries Corporation (this plant was set-up in 1983). Overall, however, very little funding came from government loans, which accounted for a mean average of just 2.5% of total costs across all manufacturers. Perhaps surprisingly, although it was somewhat more important, only in a few instances did rice shellers derive part of their initial capital as a result of agricultural activities. Indeed, just 22.5% of entrepreneurs farmed any land. Not unexpectedly, there were some notable exceptions. Thus, one owner obtained 75% of the money for his 1961 factory from agricultural earnings, while another invested farm earnings for half of the required funds for the factory he established in 1974. One sheller who began production in 1990 even gained all of the initial capital for his factory from selling his agricultural land. As a final consideration, initial investment funds also came from sources like family loans and foreign remittances. However, in total these two only accounted for a mean average of 7.5% and 6.2% of the initial factory costs for rice shellers, respectively.

Given the different emphasis that personal funds and commercial bank loans had over time, it is pertinent to ask if these various investment patterns changed during the 20 years that followed the Green Revolution. Already it has been shown that owners relied more on bank loans in the post-Green Revolution period than prior to it; with the sense that this was a vibrant economic sector which would yield a return on investment playing a part both in the willingness of farmers to take out a loan and in the willingness of banks to make loans. Providing further insight on this issue, questions were asked about the source from which funds came for production expansion in existing factories. The survey results reveal that most of the investment for production expansion also came from the entrepreneurs' own resources, as well as from bank loans. In fact, production expansion requiring further capital investment only occurred for 30.0% of rice shellers, but of these more than half (52.7%) only used funds from their own resources (out of which just over two-fifths of factories were established after 1969), and only 12.7% of entrepreneurs who expanded their factory drew all funds from a bank loan. Another 21.3% of entrepreneurs drew at least 50% of the total expansion costs from their own personal funds, with only 12.7% of factory owners taking 25% or less of the total costs from their own resources.

Factory Expansion The survey results offer clear evidence that the growth of the rice shelling industry after the Green Revolution has owed much to the availability of raw materials from farms. Moreover, evidence on investment finance indicates that funds were largely drawn from each entrepreneur's own resources or else from bank loans taken out by the entrepreneur, which helps confirm that growth in the rice shelling industry was spontaneous rather than planned or controlled by government or large corporate decision-makers. The strength of farm-manufacturing growth linkages is further confirmed when we examine the recent production experiences of rice shellers (i.e. over the five years prior to the survey). Questions on the recent past were directed at rice shellers in order to see if changes in rice shelling activities were still being influenced by local farm produce considerations some time after plants were established. Hence, inquiries were made regarding the incidence and reasons for any change in the type of raw material that was consumed in factory production, about fluctuations in the volume of production, on any diversification of finished products from factories and on changing patterns of marketing within the state (these questions were restricted to the last five years from the date the survey was undertaken because this decreased the chances of inaccuracy due to memory failure and increased the chances that factory records could be drawn on to obtain exact information).

Looking at sources of raw materials first, all rice sheller replies confirmed that the type of raw material they used had not changed in the last five years. Illustrating the view of most rice shellers, one simply said: 'Rice sheller's machinery is especially made for paddy shelling, so it is impossible to switch on its operation for other purposes. But in reality, we never face shortages of paddy, so the idea of changing the type of raw material is thousands of miles away from us'. Moreover, all respondents stated that the source of their raw material purchases (namely regulated farm markets) had not changed and that purchases had never been made from outside the state. For instance, representative of many sheller owners, one commented: 'Paddy purchasing from outside the state? I am surprise why you are asking this question. I think you do not know much about Punjab state, particularly its supremacy in paddy farm output'. The responses to these questions indicate that all plants which were engaged in rice shelling were solely occupied with this activity, so that 100% of their raw material input costs were comprised of paddy rice (excluding operating costs like electricity).

In answer to the question about changes in the volume of plant production in the 20 years since the Green Revolution, operators indicated that there had been sustained growth in line with farm production, which has continued to expand. In the five years prior to the survey period, for example, the volume of production had increased in 30% of the factories, with the result that 62.6% of these plants had to extend their hours of work (the capacity of rice shelling per hour remained the same but the operating period was extended in order to shell more paddy), while 37.6% of these shellers had installed new machinery which had helped raise their output. Significantly, of this 30%, finished products sales made within the Punjab had changed for just 46.0% (that is, for less than half of those who had recently expanded production), with nearly half of those factories that had expanded production having increased their sales of rice bran (rice bran is consumed in rice bran oil manufacturing in medium/large-scale factories). The rest had seen their sales increase to buyers from out of the state.

However, these increased sales outside the state do not point unambiguously to a self-generated export potential, for, apart from rice bran, which is now deregulated, the distribution of both paddy and shelled rice is controlled by the national government, with rice shellers only being allowed to sell 25% of their total production as they wish, with the remaining 75% delivered to the Food Corporation of India. Although an investigation of forward linkages for rice shelling plants is beyond the scope of this investigation, it is nevertheless instructive to note the way in which local links with the rice shelling industry have promoted the development of medium/large-scale rice bran oil factories in the area. For this reason, all of the medium/large-scale rice bran oil manufacturing plants within the survey area were approached and asked to complete the survey questionnaire. From this exercise, all of the factory owners confirmed that the sole reason why they set-up up a factory where they did was the abundant availability of rice bran within the local area. (Government restrictions are not applied to rice husk and rice bran polish and the survey results show that all husk and rice bran were sold within the state. The rice husk is mainly consumed within the factory as a fuel.) The fact that the four rice bran oil manufacturing plants in the survey area were established in 1978, 1979, 1980 and 1986 shows that the strength of attraction of the rice shelling industry in this area continues long after the Green Revolution started (no rice bran factory existed before the expansion in rice shelling activity in the survey area). Owners confirmed that they purchased all of their rice bran from local shellers.

Summary The survey results reveal that 92.5% of rice shelling enterprises were set-up after 1969. At the time production started, no factory moved in from another part of the state or from elsewhere in India. What owners confirmed was that the availability of agricultural raw materials (paddy) was the prime factor in promoting new rice shelling activity. The fact that this activity was deemed to be profitable was another reason for starting a shelling operation, with this factor lying behind the willingness of shellers to take out bank loans to start or expand production following the Green Revolution. The continuing impact of farm product expansion on manufacturing growth is seen in the recent establishment of plants, in 30.0% of plants having expanded production in the last five years, and in the attraction of rice bran oil producing units to the region.

'Input' Linkages with Agricultural Machinery Manufacturing

For small-scale agricultural machinery plants, the selection of areas within which to conduct interviews was partly decided in the light of the areas that were chosen to examine rice milling. Nevertheless, the districts selected were particularly appropriate for an investigation of farm machinery production as the two districts of Jalandhar and Kapurthala had the largest and the smallest number of small-scale agricultural machinery manufacturers in the state in 1990 (according to unpublished files at the Punjab Directorate of Industries). This meant that these two survey districts provided contrasting areas. Variety in the intensity of machinery production was further confirmed by examining the ratio of the number of farm operated machinery implements to the net farm area that was sown in each district (these data were taken from the publications, Punjab Economic Adviser to the Government, Statistical Abstract of Punjab, 1990, and Punjab Economic Adviser to the Government, Block At-A-Glance, 1992). Although these data do not cover all types of farm machinery implement, the picture obtained is sufficiently comprehensive to shed light on the general features of farm mechanisation. Standardising data in this way we find that the Kapurthala district records a net area sown per farm-operated implement that is exactly the same as the state average (at 2.8 hectares per tractor, thresher or tube-well), while Jalandhar district is representative of a group of areas with an intensity of operated farm machinery that lies just below the state average (Table 6.4).

Within the two districts selected for the farm machinery survey, a multi-stage stratified sampling procedure was adopted with the district as the primary unit and the manufacturing plant as the ultimate unit of enquiry. This procedure involved the systematic sampling of plants within groups that covered different types of machinery production. The fact that these samples were derived within districts was provoked by the lack of official secondary data for tehsils, which made it difficult to identify patterns of agricultural machinery manufacturing below the district level. At the same time, during my first research visit to the Punjab (prior to the survey), it was recognised that

Table 6.4

Farm-Operated Machinery Numbers and Net Farm Area Sown by District, 1990

District	Net Sown Area (000s hectares)	Number of Operated Implements* (000s)	Net Sown Area Per Implement (hectares)
Amritsar	432	142	3.0
Bhatinda	498	116	4.3
Faridkot	526	156	3.4
Ferozepur	504	135	3.7
Gurdaspur	262	77	3.4
Hoshiarpur	252	65	3.9
Jalandhar	291	128	2.3
Kapurthala	154	54	2.8
Ludhiana	326	171	2.0
Patiala	380	185	2.1
Rupnagar	115	45	2.5
Sangrur	451	200	2.2
Punjab	4,191	1,474	2.8

*farm implements data refers to tractors, threshers and tube-wells

Source: Punjab Economic Adviser to the Government, Statistical Abstract of Punjab (1990) and Punjab Economic Adviser to the Government, Block At-A-Glance (1992).

farm machinery manufacturing was mainly centred around small towns (this concentration was later confirmed by obtaining lists of agricultural machinery manufacturing plants from the District Industries Centres). What was also clear is that there was considerable geographical specialisation in farm machinery production (e.g. there was a concentration of chaff cutter firms in Goraya town, a significant number of factories manufacturing tractor parts in Phagwara town, high thresher production in Nakodar town, and so on, with local informants indicating that such places are well-known for offering an industrial atmosphere for their specialised production). This meant that if the tehsil had been selected as the geographical scale within which a sample was selected, then the sample drawn would likely have been dominated by a limited variety of machinery product types. By selecting plants within districts, a greater variety and more representative distribution of machinery producers was obtained. Hence, to get a more appropriate spatial distribution of farm machinery manufacturing, districts rather than tehsils were chosen as the framework for conducting the agricultural machinery producer survey.

When selecting factories within the districts, a major consideration was to cover different types of agricultural machinery production, giving equal weight to both the districts investigated. For this purpose, nearly all types of implement manufacturers were included within the sample plants (i.e. threshers, tractor parts, levellers, tillers, planters, seed drills, etc.). According to unpublished files at the District Industrial Centres in Kapurthala and Jalandhar, there were 105 small-scale agricultural machinery manufacturing plants in Kapurthala district and 322 in Jalandhar district (during the period of the survey). Drawing equally from both districts meant that 23 plants were selected from Kapurthala and 72 from Jalandhar. The final stage in the stratified sampling procedure that was used was to draw plants from lists of each type of implement producer, in proportion to the percentage of all plants that made that implement. This was done by arranging plants by 'sector' (and then by district within sectors) and taking a systematic sample to ensure proportionate representation of both implement types and their geographical distribution.

Growth in Agricultural Machinery Manufacturing

There is no doubt that both the number of units and the volume of production for agricultural machinery plants have increased in every district of the state in recent decades. In the ten years from 1980 to 1990 more than a two-fold increase in the number of units that either produced or repaired agricultural machinery was recorded for the state as a whole, with the number of units in these two categories in Kapurthala rising from 73 in 1980 to 250 in 1990, while Jalandhar saw an increase from 332 to 667 (Table 6.5).

Table 6.5

Small-Scale Agricultural Machinery Manufacturing by District

Districts	1980			1990		
	Plant Numbers	Production*	Output* Per Plant	Plant Numbers	Production*	Output* Per Plant
Amritsar	156	146.6	0.9	788	693.1	0.9
Bhatinda	181	71.9	0.4	522	725.9	1.4
Faridkot	490	376.0	0.8	894	941.0	1.0
Ferozepur	264	145.7	0.5	544	1,255.0	2.3
Gurdaspur	220	159.0	0.7	611	421.4	0.7
Hoshiarpur	152	15.9	0.1	302	93.2	0.3
Jalandhar	332	516.0	1.5	667	1,582.8	2.4
Kapurthala	73	118.5	1.6	250	372.4	1.6
Ludhiana	310	602.4	1.9	638	1,510.0	2.4
Patiala	187	111.2	0.6	518	540.0	1.0
Rupnagar	124	179.9	1.4	475	551.5	1.2
Sangrur	420	150.0	0.4	927	523.1	0.6
Punjab	2,909	2,961.0	1.0	7,136	9,210.1	1.3

*production in 00,000 rupees (output per plant in some districts is below than million rupees, so the production figures are kept in 00,000 rupees)

Source: unpublished files at the Punjab Directorate of Industries.

Providing an indication that this increased production might well have been destined for local buyers is straightforward, for we can see this if we examine the degree to which local farmers have increasingly used machinery in their farm operations (Table 6.6). While it might be the case that the increased number of implements that are in usage did not come from manufacturing plants within the same district, it is certainly clear that the increased utilisation of agricultural machinery implements was widespread over these districts. To obtain evidence on whether local suppliers fed this growth in farm machinery usage we turn to the questionnaire evidence obtained from the 1992/93 survey of agricultural machinery producers who were interviewed as part of this investigation.

Table 6.6

The Use of Operated Machinery on Farms in Jalandhar and Kapurthala Districts by Blocks

	Number of Machines on Farms (00s)*		
Block	1977/78	1985/86	1989/90
Jalandhar district	783	1181	1283
Adampur	55	69	70
Aur	56	85	100
Banga	67	87	90
Bhogpur	37	89	93
Jalandhar	151	204	214
Nawan Shahar	87	97	108
Nur Mahal	37	73	83
Nakodar	101	135	139
Phillaur	72	84	92
Rurka Kalan	28	87	88
Shahkot	92	171	206
Kapurthala district	399	494	541
Kapurthala	138	166	170
Nadala	96	133	150
Phagwara	62	75	80
Sultanpur Lodhi	103	120	141

*farm machinery data refers to tractors, threshers and tube-wells

Source: Punjab Economic Adviser to the Government, Block At-A-Glance (1985, 1990, 1992).

Assessing Links Between Farms and Agricultural Machinery Plants in Jalandhar and Kapurthala Districts

In examining linkages between agricultural machinery manufacturers and the farm sector, similar indicators were used to those applied for rice shellers. First, the timing of the opening of manufacturing plants was investigated, followed by an analysis of the reasons why production started in particular places, and why plant owners constructed new factories. These inquiries were expected to give a clear indication of whether manufacturing plants were established due to expansion in local farm production or if growth in these plants was based on demand from outside the state. Moreover, to check that growth in plant numbers was not promoted by government planning programmes or by large companies, the source of finance for constructing or buying a new factory, and the sources of financial contributions for expanding production, were considered. In addition, the degree to which sales of implements were made directly to farmers was examined by looking at the marketing of manufactured implements and assessing the relative importance of sales to farmers, other manufacturers, wholesalers, retailers, government agencies, etc. This analysis was undertaken in case factory sales were mainly made to wholesalers or other manufacturers, who then had the capacity to sell-on anywhere in the country. Adding a further dimension to the analysis, the reasons for any change in the type of finished product of a factory, and the causes of any fluctuation in the volume of its production, were examined. Here, the intention was to assess how far changes in the type of finished product and in the volume of production were influenced by farm demand.

Factory Growth Agricultural machinery manufacturing started in Jalandhar and Kapurthala districts far earlier than the arrival of new farm production technologies in the mid-1960s. The oldest factory in my survey established its operations in 1914, with the next oldest plants set-up in 1929, 1937 and 1941 (however, the survey results do indicate that a sudden increase in the number of plants only happened after 1970, so the analyses undertaken in this section are made for plants set-up before 1959, between 1960 and 1969, over the 1970-79 period and after 1980). In all, 13.7% of plants started production before 1959, while 16.8% opened over the 1960-69 period. The number of factories increased substantially in the next decades, with 33.7% of plants being established between 1970 and 1979 and 35.8% being set-up after 1980. As Table 6.5 indicates, this pattern of increase is consistent with recent general trends in the state, so that while some plants that opened in earlier decades might have closed by the time of my survey, the general picture of a large number of recently opened plants reflects general trends. If anything comparison of the general pattern for the Jalandhar and Kapurthala districts with the plants in my survey shows that my sample has a lower proportion of plants established in the 1980s than is the norm for these districts. Thus, while 35.8% of the surveyed plants were established in the 1980s, the figure for the whole of Jalandhar and Kapurthala districts was 58.0%. Even this district level figure is down on the state-level percentage, which stands at 59.2% (Table 6.5). As a consequence, my results on new plant creation actually down-play recent growth pressures. Certainly, during my various meetings with District Industries Centre officers, they always assured me that the number of small-scale agricultural machinery plants had been increasing in every year, and particularly after the 1970s. The general message is that the trend is toward growth, so the omission of a small number of firms that have closed in the past is unlikely to change the message about dominant trends that the survey is able to provide.

Analysis shows that the majority of plant owners bought or built their factory due to the direct influence of local farm activities. Supporting the view that firms were set-up in response to higher demand for farm machinery, 64.2% of plant owners confirmed that demand from farmers 'made' them enter this business. For example, one entrepreneur said: 'I used to do repair work in a small shop. Eighteen to twenty years ago a farmer came to me and asked if I can make a similar farm implement [as used by his friend]. I agreed [to do this] for him by taking some advance money as a deposit and since that period my production has been increasing every year'. In addition, 85.3% of factory owners held that they had entered this business due to a generally encouraging market atmosphere. One plant owner mentioned this general atmosphere in a simple but representative way: 'Long ago, when I decided to open a shop [i.e. a small manufacturing unit], everybody suggested to me to go for farm implement manufacturing'. In all, 14.7% of entrepreneurs indicated that they had entered this sector because their family was involved in the business over a long time period (often their parents used to manufacture implements in small shops, but usually the present owner had built or bought an additional factory because he wanted more space for manufacturing). Notably, analysis of the data indicates that those factories which were created due to the heredity nature of this occupation in their family were mainly established before 1960 (Table 6.7), and compared to other factories decisions on establishing these units were little influenced by demand from farmers for farm machinery. For instance, as one manufacturer commented: 'Demand from farmers did not make our parents start this business, but this was the only skill they had for making their living and the same skill they passed on to us for our living'. Offering another perspective on this, one respondent remarked: 'Because of unemployment and financial problems, other fields were closed for me, so I forced myself to join my father's business for my living'.

These personal reasons (e.g. an heredity occupation) became less significant factors in the establishment of factories that were set-up after 1960. After this period, as factory owners repeatedly emphasised, demand from farmers was always the dominant reason for starting a new agricultural machinery plant (Table 6.7). Significantly, the reasons owners gave for starting a manufacturing operation in this sector did not differ greatly with the size of the factory. Yet there was variety in factory size, with 71.6% employing less than ten workers, 13.7% with 11-20 employees, 10.5% employing 21-50 workers and 4.2% with more than 50 on the staff.

Table 6.7

The Main Reason Plant Owners Set-up their Agricultural Machinery Factory (%)

Reasons	Date Factory Started			
	1959 or earlier	1960-69	1970-79	1980 or later
Demand from farmers	38.5	62.5	68.8	70.6
Encouraging atmosphere	0.0	31.3	25.0	20.6
Heredity occupation	61.5	6.2	6.2	8.8

Factory Site Selection Here we should distinguish between newly established factories and those plants that were set-up in existing buildings, in case the latter had more constrained locational choices (although only 10.6% of plant owners moved into an old building). For newly built factories, 40.0% of units were located where they are due to personal contacts with local farmers (demand from whom provided the encouragement for owners to start an operation in farm implement manufacturing). For example, one manufacturer commented: 'I have chosen this site due to my home village. Farmers of this village are just like my friends and they have always encouraged me to stay in this business'. And 46.3% of factory owners believed they had an assured market for farm implements due to the increased usage of different types of farm machinery in their local area. As one plant owner said: 'I never worry about my sales but always worry about the completion of the farmers' orders'. These 46.3% were influenced both by local demand from surrounding villages and by demand generated by well-known market towns in the state (40% of my surveyed factories were situated in the so-called industrial belt of the state, on the main road from Jalandhar-Ludhiana to Delhi). An additional illustration of the role of geographical proximity is given by four factories which were set-up near village grain markets, so farmers could buy implements on their way to or from the market. For a similar reason, one large-size unit with 85 workers was established in 1978 near a sugar mill. The remaining 13.6% of factory owners listed the main influence on the choice of their factory site as being social causes, like owning a piece of land near their home (although when they were asked why they did not start production in a manufacturing sector other than farm implement production, their responses confirmed that it was the increased usage of implements on farms that was felt to assure them of a market for their finished products).

The 10.6% of entrepreneurs who established their operations in an old building provided two main reasons for doing so. The first was simply due to a shortage of finance, while the second was because buildings were available within the well-established market for farm implements on the main road of the industrial belt of the state. The survey results reveal that these old buildings were generally used as repair shops for farm machinery before the present plant owners started using them for machinery manufacturing. Most owners decided to use their present shop because farmers were familiar with the place, as they had been used to coming to that place for machinery repairs. All these factory owners bought the shop they now use, with most of the previous owners only selling the shop due to a lack of finance. Yet in all cases the new owner allowed repair work (and the former owner) to continue in one corner of the shop or even in some cases in the front yard of the shop. Only two of these established factories were not previously linked to agricultural machinery production (both were carpenters' shops before they came to be used for farm implement manufacturing). When these reasons for factory site selection were examined for both new and old buildings, as well as for different time periods, it was again found that after 1960 the key factor was the expected demand for factory produce from farmers which gave the sense that there was an assured market locally for farm implements. For instance, representative of the views of most of the manufacturers, one commented: 'We always have had a long list of farmers' orders, mainly with a deposit but sometimes with full payment in advance'. In all, 49.5% of plant owners established their factories where they did due to a belief in the general existence of demand for agricultural implements. Knowledge that local farm demand existed made another 38.9% of manufacturers start in this line of business (only 11.6% of entrepreneurs were influenced primarily by other reasons). Only prior to the 1960s do we find that other reasons, such as heredity occupation, were major considerations in plant location (Table 6.8).

Table 6.8

The Main Reason for Site Choices for Agricultural Machinery Factories

	Percentage Naming this Reason by Year			
	1959 or earlier	1960-69	1970-79	1980 or later
Knowledge of local farm demand	46.2	18.8	34.4	50.0
Belief in general demand	30.8	68.8	56.3	41.2
Heredity occupation	23.1	12.5	6.3	8.8
Other*	0.0	0.0	3.1	0.0

*one factory was set-up because it was near a sugar mill.

Significantly, the reasons for site selection were no different for factories with less than 10 workers than for those with 11 to 20 employees, with both reporting that general demand for farm machinery was strong. However, for large factories, with 21 to 50 workers, the primary attraction was reported to be personal contacts with farmers, whereas for factories with 50 to 100 employees it was the sense that there was an assured market for their farm implement sales (although plants with more than 20 workers only accounted for a 14.7% share of all surveyed factories). In general, plant owners were mainly attracted by both personal contacts with farmers and by their belief that local sales for their products would be assured. This means that agricultural machinery manufacturers were not only encouraged to establish factories by increasing demand from the farm sector in general but were attracted to particular locations by their belief that strong demand existed within a particular locality.

Factory Expansion Nevertheless, it is critical to identify the long-term effects of farmers' demand for farm machinery. Hence, an inquiry was made to see whether, even 20 years after the Green Revolution started, local farm activities continued to encourage plant owners to introduce new types of implement production or if farm production still encouraged factory owners to increase the volume of their plant's output (questions were asked concerning changes made in the five years prior to the interview survey). During this period, 20.0% of plant owners admitted to having made changes in the finished products of their factories. Of these, just under three-quarters (73.5%) introduced a new type of implement for which they felt that market demand was strong, so operators believed they would increase their profitability. The remaining 26.5% replied that it was demand from farmers that encouraged them to increase the range of implements they manufactured.

As well as changes in the type of product manufactured, the volume of production within factories changed in 69.5% of units. In all, 59.9% of plant owners indicated that their plant had seen production expansion within the last five years (only 9.5% of plant owners admitted to production decreases which they blamed on the recent unstable political situation of the state). Of these, 89.3% of enterprise owners stated that it was demand from farmers that had encouraged them to produce more implements (this was admitted by 48.5% of entrepreneurs having less than ten workers, by 61.5% of plant owners employing 11-20 workers and by 80% of large units with 21-50 employees). The remaining 8.8% admitted that it was the level of profitability in this business that led them to increase production. Only one plant owner said that production increased due to being able to increase sales to buyers from out of the state. The survey results show that production had not only increased in recently established factories (e.g. those started after 1980) or in well-established plants (e.g. those opening prior to 1959), but happened in factories of all ages. And more than half of these factories had less than ten workers. This means that a production increase was more inclined to be due to farmers' demand and did not reveal sharp contrasts in line with the age or size of a factory.

Factory Investment One significant factor in the creation of these manufacturing plants, which reveals the potency of producers' images of the strength of demand from the farm sector, is the manner in which they drew on their own monetary resources to pay for factory construction or for building refurbishment. As one of the factory owners mentioned: 'When farmers ask for a particular implement and assure us of its purchase, we always try to arrange finance by hook or by crook, for how can we sit here and wait for government finance? We also feel that government departments do not want to know this small-scale business. Why should they? If Punjabi farmers themselves are clever enough to encourage us to introduce new implements and make us earn money'. Thus, as with rice shellers, the survey revealed that government subsidies played a negligible role in paying for factories, with only 5.2% of all of the factories surveyed obtaining any government subsidies (just one unit of which received all its initial funding from this source). By contrast, a mean average of 62.1% of manufacturers' costs came from their own financial sources and only one manufacturer obtained all the money that was invested from bank loans. Nevertheless, as with rice shellers, the share of costs that came from the owners' own resources was greater in factories that were established before 1969 (Table 6.9), which suggests that perceptions about the vitality of this manufacturing sector have strengthened over time; either in that this image of vitality encouraged more entrepreneurs to take out loans to fund their investment (or speed up its implementation) or that those who were able to loan money (i.e. the banks) were more inclined to see their funds going into this sector because they viewed operations in it as a good investment. In truth, however, the survey data does not allow us to assess whether this indicates a greater willingness of banks to loan funds or a stronger desire to enter this sector. The important point is that this pattern of increased usage of bank loans indicates a strengthening desire to invest in the agricultural implements production sector, although the dominant trend has always been one in which entrepreneurial resources were the key element in investment decisions. Very evidently, then, investment decisions were spurred primarily by recognition of profit-making opportunities rather than by government inducement.

Table 6.9

Percentage Share of Entrepreneurs' Financial Resources in the Cost of Agricultural Machinery Plants

Period started	0	15-40	50-75	80-90	100
1959 or earlier	0.0	0.0	0.0	15.4	84.6
1960-69	6.3	0.0	6.3	6.3	81.1
1970-79	0.0	12.5	25.0	12.5	50.0
1980 or later	8.8	14.7	17.6	3.0	55.9

There are gaps in the percentages indicated in this table as no factory owner used the omitted percentages of their own resources.

Yet there is one caveat that should be added here, for set within the results, the survey indicates that reliance on entrepreneurs' own resources for large shares of initial investment costs was not simply a feature of small factories that employ less than ten workers (which account for 71.6% of surveyed plants). Thus, the mean average share of total factory costs coming from the entrepreneurs' own pockets was 58.8% for these smaller factories, 69.2% for plants having 11 to 20 workers and 71.4% for larger units. Not surprisingly, this lack of difference is also apparent in the usage of bank loans to fund plant investment. While the only plant that drew all its finance from a bank loan had less than five workers, amongst those plants with under ten workers just 30.9% used any bank loans, with the percentage for plants with 11-20 employees standing at 30.8% and that for larger plants being 28.6%.

Another significant indication of the surveyed entrepreneurs' desire to stay in the farm implement business, even 20 years after the Green Revolution began, is seen by analysing financial investments for production expansion (this question was also asked with reference to production increases in the five years before the survey). Production expansion had occurred in three-fifths of the factories (59.9%). For these, the factories that expanded by drawing all costs from the entrepreneurs' own funds stood at 57.9%. Of these factories that expanded, amongst those with less than ten workers 79.4% draw all funds from the owners' personal savings, with 30.8% of units employing between 11-20 workers doing so and 20.0% only using their own resources for factories with 20-100 employees. Only 20.6% of the factories that had less than ten workers used any amount of funding that came from a bank loan (the figures were 69.2% for plants with 11-20 employees and 80.0% for units having 21-100 workers). Contributions from other sources were even more meagre, with only one plant using agricultural income to pay for as much as half of the costs of expansion, two relying on government subsidies for the same share, and foreign remittances accounting for between one-fifth and two-fifths of costs in only two plants.

Consistent with the results for new factory financing, 55.5% of all the plants which both had less than ten workers and had all their costs for expansion paid from the owner's savings, were established after 1980. It seems that local farm activities are still encouraging late-comers to expand production in farm implements manufacturing, but this does not mean that older, established factories were not influenced by local farm activities. In addition, it is worth noting that investment patterns for constructing/buying a factory did not vary between plants whose owners relied on the factory as their sole source of income and plants whose owner had another source of income.

<u>The Marketing of Farm Implements</u> As noted above, the majority of responses from agricultural machinery producers confirmed that they started production due to the presence of demand from farmers for new machinery and machine implements. What this statement does not indicate is whether this farmer demand came from outside the state or from within it. To assess this, questions were asked about the marketing or sale of manufactured farm implements. The main focus of this inquiry was to establish the extent to which the sale of agricultural machinery went to local farmers. Looking first at the range of products of the plants, the survey revealed that many types of implements were manufactured. The products themselves included trolleys, tillers, threshers, levellers, disc harrons, chaff-cutters, seed drills, planters, ridgers, tractor parts, pump sets, sugar-cane crushers, engine parts and reapers, as well as a wide array of less common products, plus repair work. No factory specialised in only a single product, for a variety of different types of product were manufactured and repair work was undertaken in every single plant. For each product, the combination of sources of sales revenue

and types of manufactured product varied across plants. Thus, only 7.4% of factories made chaff-cutters, just 5.3% of factories produced tractor parts and only 3.2% of plants manufactured engine parts.

The most prominent products in the majority of factories were trolleys, tillers, threshers, levellers, and disc harrons. They accounted for the major share of sales revenue. In all, 53.7% of factories made trolleys, 44.3% tillers, 36.8% threshers, 33.7% of units produced levellers and disc harrons were made in 29.4% of factories (Table 6.10). To identify the extent to which the sales of these products went to Punjab buyers, plant owners were asked to state the share of their sales revenue for each product that came from within the state. The survey demonstrates that most factories sold all their production within the state (although this obviously only refers to the first point of sale, so some of the output could have been sold on). Only for threshers, tractor parts, sugar-cane crushers and engine parts were sales recorded out of the state (Table 6.10). For these, out of the 36.8% of all factories that produced threshers, 88.6% sold all their threshers within the state. Of the rest, two thresher manufacturing factories marketed just 20.0% of their thresher sales within the state, one sold 25.0% of its threshers there, and one plant made 80.0% of its traded sales within the state. Those factories which made thresher sales outside the state were all older, established plants that had begun operations before 1970 (all these units had more than 25 workers). Two tractor parts manufacturing factories also made their sales outside the state. It is interesting to note that these were established in 1957 and 1959 and had 25 and 15 workers. This points to the tendency for well-established, larger factories to be the ones that sell products outside the state. The sales of small-sized factories, with less than ten workers, were always made within the state. Out-of-state sales by sugar-cane crushers were also made by well-established factories (which were set-up in 1914, 1937, 1967, 1969 and 1970 and employed 10, 20, 50, 30 and 50 workers, respectively). A similar pattern was found for engine parts manufacturing. Here the plants that had sales outside the state were set-up in 1959, 1963, 1965 and 1967, with 10, 14, 20 and 11 workers, respectively.

Table 6.10

Farm Implement Sales within the Punjab and Sales Revenue from Farmers (percentage)

Product	Factories Making a Product	Mean Average Sales within the Punjab	Factories Selling to Farmers	Mean Average Share of Sales to Farmers*
Trolley	53.7	100	48.4	99
Tillers	44.3	100	43.2	99
Threshers	36.8	93	34.7	99
Levellers	33.7	100	33.7	100
Disc Harrons	29.4	100	29.4	100
Chaff-Cutters	19.0	100	9.5	5
Planters	14.7	100	14.7	100
Seed Drills	14.7	100	13.7	100
Ridgers	11.6	100	10.5	100
Tractor parts	9.5	89	2.1	75
Pump Sets	6.4	90	1.1	100
Cane Crushers	5.3	7	5.3	13
Engine parts	5.3	60	2.1	5
Reapers	4.2	100	4.2	100
Repair work	61.1	100	54.7	100

*this percentage is computed for factories that sell to farmers only.

What should be noted is that the remarkably high share of finished product revenues that came from within the state did not have to be final sales, nor sales to local farmers. Quite often these products may have been purchased by wholesalers, who could then have marketed their purchases anywhere in India. To trace sales from plant to wholesaler and then on, perhaps via a number of steps to a point of final sale, was beyond the scope of this study. However, one clear indication of the extent to which plant production went to local farmers could be obtained by investigating the extent to which sales from these factories went directly to farmers within the state. For this, the evidence reveals that the surveyed factories sold all their levellers, disc harrons, planters and reapers directly to local farmers, and the major share of sales revenues from trolleys, tillers, threshers, seed drills and ridgers also came from local farmers (Table 6.10). For instance, of those factories that manufactured trolleys (53.7% of all factories), 86.2% sold at least 99% of their output to farmers (the remaining sales went to other manufacturers and to wholesalers). Similarly, 99% of the output of the 44.3% of factories that made tillers went to farmers (the exception was one factory where 20% of tillers were sold to wholesalers). In fact, most of the sales revenue from the other major products, like threshers, levellers, disc harrons, seed drills and ridgers, also came directly from farmers (Table 6.10).

By contrast, a very small share of chaff-cutter sales revenue came from farmers. For instance, none of the factories sold all their chaff-cutters to farmers. Indeed, out of all chaff-cutter producing units (19.0% of all plants), only half of the factories marketed any sales to farmers (the remaining share of their sales went to wholesalers and retailers). And sales revenue from tractor parts, pump sets, sugar-cane crushers and engine parts also came mostly from wholesalers and retailers. However, production of these few products (i.e. chaff-cutters, tractor parts, pump sets, sugar-cane crushers and engine parts manufacturing plants) contributed very little to overall sales volumes compared with trolleys, tillers, threshers, levellers, disc harrons, chaff-cutters, planters and seed drills manufacturing plants. Hence, the small share of sales revenue for these products that came from farmers does not influence the dominant trend in the survey results, which show that the major share of sales revenue for most factories came directly from farmers.

Summary The survey clearly indicates that farm implement manufacturing was stimulated by increased farm output in local areas. One indication of this is that 69.5% of interviewed factories started their production after 1969. In all, more than 70% of plant owners admitted that it was demand from local farmers that made them enter into this business. The long-term effects of such farmer encouragement was seen in factories largely selling their output to farmers, with 59.9% of plant owners stating that production levels had increased in their plant in the last five years. Of this 59.9%, more than half of the entrepreneurs obtained all the costs for the expansion of their factories from their own pockets, and almost nine-tenths confirmed that it was farmer demand which inspired them to produce more farm implements. The fact that there was a generally encouraging market atmosphere was further seen in 62.1% of plant owners using their own financial resources to pay for initial investment in their manufacturing plant. Overall, therefore, there was a clear pattern of manufacturing growth being tied to entrepreneurs' images of strong and continuing demand for their products from the local farm sector.

Agricultural Income and Manufacturing Activities

Having discussed farm 'output' linkages for the rice sheller industry and 'input' linkage interaction with agricultural machinery manufacturing, it is still not known whether it was income derived from increased farm production that was invested by small-scale rice shellers and agricultural machinery manufacturers when they established or enlarged their factories. I tried to explore this issue during entrepreneurs' interviews. But it soon became clear that this issue would be difficult to assess. The major problem for agricultural machinery manufacturing was that entrepreneurs usually started their business with very little investment (which was sometimes even borrowed from farmers in the shape of an advance deposit), and later on they reinvested their factory profits for expansion. In the rice sheller industry, most factory operators were commission agents in regulated farm markets or else factories were owned by a so-called business community partnership of those who drew investment contributions from a variety of sources linked to their own (other) business activities, like shops, fertilizer agencies, other manufacturing activities, brick making plants, etc. Hence, any actual farm income that did contribute to manufacturing activities was difficult to trace. Having identified these problems during the first set of interviews undertaken (and the pattern was found throughout the interviews), I decided to contact farmers over this question (mostly in the evenings during my six months stay in local villages, or on the way to interviews in factories by visiting regulated farm markets). In the end interviews were conducted with 55 farmers. These included landlords with more than 30 acres of land, farmers with 10-20 acres of land and those who had less than ten acres of land. Although these interviews did not ask for exact figures, the overall spending that was made from farm income was not difficult to judge from the discussions that were undertaken on personal financial affairs (exact figures were not sought as I was aware that most farmers do not keep exact accounts of their costs and income).

Although this information does not provide a sufficient basis to judge the relative potentials of farm income in development processes, formal discussion with farmers, and with bank managers in four villages, did provide additional information on the usage of income from agricultural activities. It was found that in farmers' immediate expenses, preference was given to buying new implements, with a secondary interest in raising living standards (e.g. by buying fridges, televisions, air coolers, motor bikes, cars, or a modern house, all of which are very common in rural Punjab these days). It was also observed that Coca Cola, crisps and chocolates are now available everywhere in villages, when no one was familiar with these products in the late-1960s or early 1970s. The large majority of farmers said that they really wanted to give a good education to their children. As a result education spending is much higher than in earlier years, and private schools are now common, not only in cities but in villages also. However, no enthusiasm was found for investing income in small-scale agro-based manufacturing (not even in the informal sector). In a few cases farmers had invested in poultry and dairy farming, and fish farming and bee keeping were also found to be an attraction for a few (both had been introduced recently and were being actively promoted by the Agricultural University at Ludhiana). Most commonly, however, small-scale farmers said that they never had enough income for any investment in a production-related activity other than agriculture. Already most borrowed from money lenders (who are mainly commission agents in the farm markets), so that much of their farm produce income went directly to money lenders (in many cases, farmers who are defaulters on payments to co-operative societies buy their fertilizer from money lenders, and when their farm produce arrives at market, the money lenders charge high rates of interest on the money lent to cover these fertilizer costs). This picture was confirmed by meetings with local bank managers, who were asked to provide information on the investment of their farmer clients and whether farmers' bank deposits were reinvested in rural areas.

These bank managers explained that the general picture for banks in rural areas was that 30% of total deposits were taken out as loans within their respective catchment areas, while 70% of all funds left the area in the shape of large-scale loans to the public sector or to private business houses. Providing further insight on the investment potential of farmers in manufacturing, these bank managers indicated that their major investors (clients) were not farmers but commission agents, fertilizer retailers and other wholesalers or retail operators. In addition, while depositors did come from the farmer community, for credits that were held for farmers, funds mainly came from family members living abroad.

Conclusion

The field survey of agro-based manufacturing attempted primarily to determine the nature and strength of direct linkages with agriculture. This meant that both the type and volume of agricultural 'output' and 'input' linkages were investigated for rice shellers and agricultural machinery manufacturing. The questionnaire results reveal that the surveyed units were the creation of individual decision-makers, and were little affected by decisions made by external company executives or even directly by government economic policies (although it has to be noted that the survey area was not one of the priority zones in which the government offered special incentives for new manufacturing investment). The survey clarifies that growth in small-scale rice shelling and agricultural machinery manufacturing did coincide with the arrival (or shortly after the arrival) of new seed-cum-fertilizer technology in the mid-1960s, although this growth has continued and strengthened in the decades since then. While the main concern of this survey was to identify the extent to which manufacturing activity was prompted by demand from the farm sector, whether seen in the manner in which local manufacturers buy raw materials from farmers, or in farm implement firms selling products to local farmers, or in decisions to start or expand manufacturing production, financial arrangements were also investigated for the construction or purchase of new factories and for production expansion. Here, the survey results indicate that manufacturing plants were again not influenced by direct government intervention, and that their reliance on the commercial banking sector was slight. The original money for setting up a plant overwhelmingly came from owners' personal resources, and most of the firms derived their expansion capital from reinvested earnings.

Critically, the questionnaire survey reveals that existing plants were set-up mainly due to the availability of raw materials (which shows direct 'output' linkages with agriculture) and increasing demand for farm machinery (which explains direct 'input' linkages with agriculture). Moreover, purchases of raw materials for rice shelling were made from within the state from agricultural produce markets, with the sale of finished machinery products mainly going directly to local farmers. The survey also clarifies that changes in the type of finished product or in the volume of production were tightly connected with local farm activities. By investigating the reciprocal ties between farm activities and 'outputs' and 'inputs' with manufacturing, this survey reveals that expansion of the two manufacturing sectors investigated was strongly dependent upon growth in farm activities.

Chapter 7

Agrarian Impacts on Manufacturing Expansion in the Indian Punjab

In this thesis agrarian impacts on manufacturing expansion in the Punjab have been evaluated by investigating state-level economic performance, temporal connections between production expansion in both sectors, the geographical coincidence of agricultural and manufacturing activities, and through a factory-level questionnaire survey, which explored reasons for plant establishment and expansion, as well as links to the farm sector through 'input' and 'output' connections. A key reason why an investigation of this kind has both practical and theoretical relevance is the rapid and sustained agricultural growth that has occurred in the Punjab since the introduction of Green Revolution technologies. These innovations were held by some commentators to have generated an 'agrarian-led manufacturing growth' model for the Third World (e.g. Gosal and Krishan, 1984; Chaudhri and Dasgupta, 1985; Chadha, 1986). This thesis has sought to investigate the basis of these claims, having been prompted to focus on this issue by counter arguments (and theoretical positions) which indicate that farm production has little effect on manufacturing expansion (e.g. Aulakh and Raikhy, 1980; Sandhu and Singh, 1983; Singh, 1987). In examining this issue, the research undertaken has mainly been concerned with direct 'input' and 'output' associations between agricultural growth and allied manufacturing expansion. From this perspective, the main conclusion from the study is that rapid agricultural transformation can be a potent instrument for bringing about a significant acceleration in overall economic growth, particularly in the small-scale agro-based manufacturing sector.

The importance of this conclusion arises from the lack of empirical research that has focused explicitly on agriculture-manufacturing growth linkages in the Third World. Certainly, there have been comments in the development literature about agriculture-manufacturing linkages. But neither comparison of net domestic products nor input-output tables nor terms of trade between agriculture and manufacturing may necessarily be indicative of a direct growth association between local agriculture and related manufacturing activities. Very evidently, in earlier research into the Punjab economy, insufficient attention was paid to the processes of spreading the benefits of development in either agriculture or manufacturing onto other sectors (Ghosh, 1977; Westley, 1986). Studies neglected altogether such aspects of linkage as the extent to which local agro-processors bought their raw materials from within the state, or the degree to which their sales of agricultural inputs were made directly to farmers. As one illustration, Gosal and Krishan (1984) only asserted that developed agricultural areas are also the prime manufacturing zones in the state (without knowing whether or not manufacturers actually did buy their raw materials locally). Above all, there have been no studies within the literature on the Punjab economy that have examined the spatial linkages of agriculture and agro-based manufacturing. Certainly, it has been generally accepted that agricultural growth has stimulated economic development within the state as a whole (even if only through farm income growth and its spin-off effects on consumer industries and services). But there remains a wide margin of disagreement between commentators on the strength of direct linkages between agricultural growth and manufacturing expansion in allied production sectors.

How Valid are Existing Theoretical Models in the Punjab?

Theoretically, an imbalance is said to exist between agriculture and manufacturing in their respective potentials for generating economic growth in each of core-periphery models, dual economy models and the Urban Bias Hypothesis. The common notion that underlies core-periphery models, such as those of Myrdal (1957) and Hirschman (1958), but even in dependency models and in World Systems Theory (Baran, 1957; Frank, 1969; Wallerstein, 1979), is that, as a result of inequities in economic and political power and of unequal exchange, capitalist development in some places (the core) necessarily creates underdevelopment in other places (the periphery), even if places are capable in the longer term of changing their standing on a core-periphery scale. Set within this idea, at times implicitly, but in models like those of Myrdal and Hirschman more explicitly, is the notion that the core dominates manufacturing activity, while the periphery holds to its 'subservient' position because of the importance of agriculture in its economic base (or more generally due to the role of the primary sector). Placed in this context, the Punjab should have provided a geographical setting in which the dependence of agriculture on manufacturing was manifest. For one thing the state economy is heavily dependent on agriculture. Moreover, despite the (relative) weakness of manufacturing traditions within the Punjab, the state exists in a nation in which inter-state trade in agricultural produce is extensive. Indeed, through the operations of national agencies for marketing agricultural produce, the Punjab is often 'forced' to export its farm output, so that irrespective of the relative performance of the Punjab's agricultural sector, we could interpret the position of the state within a core-periphery framework as 'laggardly' given that its economy is heavily dependent on the 'export' of primary products, with manufacturing activity (viz. the processing of these primary commodities) taking place elsewhere. However, it is clear that the Punjab has a highly productive farm economy. One that has been capable of sustaining economic growth levels which continue to place the state at the top of the Indian income league (with mean average income levels some 65% higher than the average for India as a whole; Shiva, 1991). Moreover, the evidence from this study, for those sectors in which a 'free market' exists, in the sense that the Government of India has not 'controlled out' the prospects of agro-based manufacturing expansion, shows that agriculture has prompted growth in manufactured output. In these sectors, agriculture has not been dependent on prompts from the manufacturing sector for its expansion. It has generated significant growth in its own right, despite being highly dependent upon the export of farm produce. Far from being a peripheral economic activity, agriculture in the Punjab is a leading economic sector.

Dual economy models also suggest that the position of agriculture is one of subservience. Here, the assumption is that a significant amount of labour in the traditional (agricultural) sector is surplus to production needs and can be transferred into the modern (industrial) sector without any consequent loss in agricultural output. The Punjab development model presents a somewhat different picture of development processes. Here, the actual experience of the economy has been one in which a transfer of surplus rural labour to the manufacturing sector has not taken place. Indeed, local labour supplies are inadequate for the farm sector, so that labour has to be 'imported' from other Indian states (Hanumatha, 1974; Johl, 1975; Grewal and Sidhu, 1979; Pollard, 1983; Chadha, 1986; Rudolph and Rudolph, 1987; Bhatia, 1988; Sharma and Dak, 1989; Bhalla, 1990; Bhalla et al, 1990;

McGuirk and Mundlak, 1991). Significantly, despite manufacturing expansion within the state, demand for farm labour remains high. Reflecting this picture of labour shortage, the survey of manufacturing plants that was undertaken for this thesis revealed that, even in small-scale rice shelling plants, a total 89.8% of engaged employees were from Bihar and Uttar Pradesh (only 5.2% came from the local farmer community), while in the small-scale agricultural machinery manufacturing sector just 23.2% of total employees were from the local farmer community. Taken together, the results obtained here provide little to support the dual economy notion of manufacturing being the leading sector and utilising resources from agriculture to fuel its own growth (An important caveat to this statement is that it does not extend to consumer based industries, for which input-output studies suggest that there are significant indirect effects of farm income growth on manufacturing expansion; see Bhalla et al, 1990. This point is a significant one methodologically, for the analysis undertaken in this thesis could not extend to investigating indirect links between farms and the broader economy. As such this investigation only provides a limited range of insights on direct agriculture-manufacturing linkages. Yet the evidence from input-output studies suggests that if indirect growth benefits are included, then the impact of agriculture on manufacturing is even more substantial than that recorded here).

Even models which cast the potential role of agriculture in a more favourable light do not seem to be that helpful in explaining the Punjabi situation. Thus, Lipton has argued that the power of urban consumers and power interests is such that they are able to direct a disproportionate share of governmental and other resources toward both urban centres and the manufacturing sector, with the corollary that resources are directed away from agriculture and the rural population. At one level we can possibly see this in operation with the Public Distribution System being directed toward ensuring that food prices are kept down for urban consumers; with (any) resulting reduction in farm commodity prices lowering farm incomes. In addition, the operations of the banking system, despite improvements over the past few decades, have tended to draw money away from rural locations towards large governmental and urban investments (Chapter Six). Yet these trends are met with counter tendencies that question the accuracy of an Urban Bias interpretation for the state. Thus, evidence from the Punjab clearly shows that it is agriculture and the provision of infrastructure for agricultural production that have received most (and a 'disproportionate' share of) government funding (Chapter Four). Moreover, expenditure priorities under the Indian five-year plan process have afforded a high place for agricultural investment (Chapter Three), with other national policies, such as encouragement for the adoption of Green Revolution technologies and the designation of the fertilizer industry as a key national economic sector, further indicating the importance that has been attached to the farm economy. Despite this, development strategies in India have not been based on agriculture-led policies. Rather, agricultural output has been driven upwards in order to feed the population and to replace foodgrain imports. The Green Revolution in India served substantially to displace food imports and build food stocks rather than acting as the base for a new development strategy (Mellor, 1986).

The important point to grasp is that the strategy of the national government was designed to raise farm output, not to provoke through this manufacturing growth. Yet, as the survey results of this thesis have shown, despite government intervention in farm produce marketing (to guarantee buffer stocks for deficit states and urban consumers; Lele, 1971), and even given national government control over the availability of key raw materials (like iron-ore), small-scale farm machinery manufacturers have been able to flourish in the Punjab, due to increased demand from farmers for their products (Chapter Six). For agro-processing of course the picture is less clear, for the national government intervenes so extensively in farm produce marketing that direct links between farm and factory at a local level are often restricted or even denied. However, when restraints are not present, as for rice processing, it is evident that agricultural growth is able to spur local manufacturing expansion. The fact that this effect did not appear to be present outside the rice shelling sector does not mean that government regulation is restricting the potential of this growth impetus; merely that it is limiting its (potential) capacity to generate local manufacturing expansion. Further work will be required to see if agriculture has a growth inducing capacity beyond its immediate production zone (i.e. in other states).

In sum, the above theoretical accounts of development and underdevelopment do not provide sufficient conviction that they are sensitive to the dynamics of development in the Punjab. Of course it is possible that relations of production are characteristic of particular countries or specific economic sectors, so that the relationships identified for the Punjab are not universal but should be expected to vary geographically. Such a prospect is implied in the notion that the Third World is not unitary; although commentators have argued that some characteristics are common to most lower-income countries (Todaro, 1989). However, the Punjab economic model does at least present the prospect of an 'agrarian-led' manufacturing growth model for those Third World regions where the major share of the local economy is contributed by a dynamic agricultural sector.

Is the Questionnaire Evidence Representative of the Punjab Experience?

The Punjab economy has undergone tremendous change over the last three decades (e.g. the per capita net state domestic product has increased from 720 rupees in 1966/67 to 9,643 rupees in 1991/92). This growth process has been accompanied by sharp changes in the balance of economic activity. Much of the rapid growth in net domestic product that has taken place in the Punjab was generated by growth in agriculture, with most of this growth attributed to improvements in crop production that resulted from increases in the overall yield of wheat and paddy rice that were the product of adopting new high-yielding crop varieties (McGuirk and Mundlak, 1991). Yet the substantial increments in farm output have not been accompanied by stability in the share of local economic activity that has been accounted for by agriculture. For instance, the percentage share in the net state domestic product that was contributed by the primary sector decreased from 62.2% in 1966/67 to 46.5% in 1991/92. During this period the percentage shares for the secondary and tertiary sectors increased from 15.3% to 21.4% and 22.5% to 32.1%, respectively (Chapter Four). These changes occurred despite the fact that the state government's five-year plan policies were more inclined towards investing in the agricultural sector. Added incentives for Punjabi agriculture arose from the heavy investments that were made to support farm production capacity (although other sectors did benefit from this investment in varying degrees). Of particular importance in this regard were the financial commitments made by governments to physical infrastructure, such as transportation networks and facilities, educational services, electricity supply, irrigation, etc. Overall, even the economic analyst of the State Government of the Punjab has argued that government expenditure has been (and is) biased in favour of the agricultural sector in the state (Bhalla, 1990). Set against this, aggregate data on the production distribution of manufacturing activity in the state shows that the most significant rates of manufacturing expansion have occurred in sectors that are not directly dependent upon agricultural raw materials or on the supply of inputs into the farm sector (Chapter Four). However, as input-output analyses reveal, there are both direct and indirect linkages between the farm sector and these other manufacturing sectors (if only through household consumption), which indicates that agrarian growth has had a beneficial growth impact on those manufacturing sectors (and on service sectors) with which the farm sector does not have strong direct production links (Bhalla et al, 1990). This does not mean that agriculture has been responsible for growth in manufacturing and services. For one thing, both national and state governments have encouraged (certain) manufacturing activities to locate within the state (or in specific places in the state) as part of national and state industrial programmes (this particularly applies to large-scale factories). But this should not detract from the fact that agriculture has indirect growth effects on manufacturing expansion, nor, as this thesis has shown, that there has been strong direct effects of farm production growth on expansion in agro-related manufacturing sectors.

It is not possible to establish a causal model that provides a comprehensive account of the overall performances of agricultural and manufacturing growth in the Punjab due to the diverse roles that different agricultural and industrial institutions have played in the development process (e.g. co-operatives, agricultural and industrial departments, state financial corporations, etc.). The control of essentially non-market institutions over major inputs into production processes (credit, fertilizer, etc.) makes conceptualisation of potential agriculture-manufacturing linkages based on the actual experiences of the Punjab problematical. Certainly, the empirical analysis in this thesis does signify that government industrial policies and incentives have had an insignificant influence on both small-scale rice shelling activity and small-scale agricultural machinery manufacturing. Economic development has occurred in these small-scale manufacturing sectors without any real political obstacles. This has occurred not only in the areas surveyed with questionnaires in this study, for farm implements manufacturing and rice shelling activity have both expanded considerably in other parts of the Punjab (Chapter Five). The empirical basis on which we can conclude that direct production linkages exist between agriculture and agro-based manufacturing are not only derived from the behaviour of individual firms and the agents with whom they interact in their decision making, but also from general patterns of change in economic sectors across space and over time (especially through a comparison of sectors with dissimilar arrays of 'outside' involvement). Analysis of different farm products and of large-scale manufacturing plants shows that tight government control does thwart (potential) growth linkages between agriculture and manufacturing within the state. What enables small-scale manufacturing plants to develop close ties with the farm sector (for some products at least) are their relative freedom from government control over their location decisions and their production volumes. These small-scale plants are not the product of direct government intervention, nor do they result from tariffs, subsidies or other import-substituting policies. With these 'sectors' of limited government regulations (both for agriculture and manufacturing), when linkages are evaluated to see if the domestic farm sector is an important source of raw materials for agro-based manufacturing, as well as a stimulus for farm input manufacturing, the evidence is of positive growth ties. These results are attained from questionnaire survey areas that have recorded levels of agricultural and manufacturing growth that are similar to general patterns within the Punjab state. Thus, according to various development indices, Kapurthala and Jalandhar districts and tehsils stand in different positions relative to the state average. Indicative of the manner in which these regions together have reflected general trends within the state, the questionnaire survey reveals that only a few rice shellers and farm implement manufacturing firms were in business before the mid-1960s, which conforms with the picture for the state as a whole. The significant conclusions from the questionnaire surveys are that plant owners decided to enter their selected production sphere because of the profitable opportunities that the farm sector offered them. This incentive extended not only to the decision to undertake a particular kind of manufacturing but also to where to locate their plants. Moreover, indicating the strength of their attraction to these farm-related production ventures, very few plant owners made use of government loans or subsidies. Indeed, there is no evidence of a significant financial transfer from agriculture into new agro-based manufacturing activities. These new manufacturing endeavours are neither government generated nor are they simply spin-offs of successful farm enterprises. They are new production units that, within a relatively free-market setting, have been established from outside the farm community by entrepreneurs who have identified potential profitability for manufacturing enterprises from agrarian growth.

Given the generality of the expansion of agricultural implement and rice processing production, it can reasonably be concluded that the questionnaire survey is representative of general trends within the state. However, it has to be said that these trends are restricted to particular farm products and only to small-scale factories. Beyond these, government regulation thwarts further close associations between growth in agriculture and manufacturing.

Is the Punjab Experience Transferable Beyond its Boundaries?

The development processes in the Punjab provide lessons for economic planners in India. Foodgrain production in India is dominated by paddy rice and wheat and farm output for both has kept pace with national population increases (annual growth in foodgrain output was 2.6% between 1955/56 and 1988/89, as against 2.2% and about 3.0% for population growth and increases in domestic demand; Ninan and Chandrashekar, 1992). Significantly, growth linkages in the Punjab are not between increased foodgrain production and related large-scale manufacturing plants. Rather expansion has occurred in arenas that are subject to more spontaneous investment opportunities; between the farm sector and small-scale manufacturing plants. For the rest of India this provides some important messages. In this regard it is important to note that, similar to the Punjab, farm production in paddy rice has grown significantly in many of the Indian states (Chapter Three). For instance, between 1967 and 1991 paddy rice yield increased by 221.7% in Gujarat, the state with the highest growth rate, while even the poorest performance, which was Karnataka, saw an increase of 12.8% (with almost all other states recording a yield increase of at least 30.0%). Subject to the absence of government restraint, there is no reason why such growth cannot stimulate small-scale rice shelling in these areas in the same way as it has in the Punjab. Moreover, growth in farm productivity should raise demand for more farm implements, which could be manufactured locally. Already we have seen that, during the Green Revolution era, the number of mechanical implements used on farms has increased dramatically across the Indian states (e.g. between 1967 to 1987 the lowest increase in all Indian states was recorded for Tamil Nadu, which was 1,474.3%, with West Bengal ranked highest with a 88,375.2% rise in farm-operated implements; India Ministry of Planning, Statistical Abstract India, annual).

One reason why a similar pattern of development might be expected in other states is that the Indian government has emphasised the need for regional balance in economic development as one of the goals and central objectives of its planning policies (Misra and Natraj, 1981; Mishra, 1985; Gautam, 1990; Bhalla, 1992). For this, the Intensive Agricultural District Programme was started (this scheme was actually introduced to distribute high-yielding varieties of seeds in one district in each state during mid-1960s; Storm, 1993), the Community Development Programme was launched in the 1970s all over India and the Integrated Rural Development Programme was introduced in sixth five-year plan (Bhat, 1981; Bhatia, 1988; Gangrade and Chaturvedi, 1989; Oommen, 1989; Tyagi, 1994). Various other centrally sponsored schemes have been introduced across India to encourage the widespread diffusion of growth benefits. Tribal Area Development, Hill Area Development and the free distribution of seeds and fertilizers for small-scale farmers, are examples of schemes that were introduced with this purpose in mind. Their implementation, according to academic research, has played an effective role in reducing intra-state disparities (Tewari, 1985), and in promoting agricultural growth in the eastern states of Assam, Bihar, Orissa, Madhya Pradesh and West Bengal (Rao, 1991). The ongoing interest of the national government in such schemes is indicated by the introduction of the Special Rice Production Programme, that was launched in seventh five-year plan to bring benefits to the eastern region of Assam, Bihar, Orissa, West Bengal and eastern Uttar Pradesh (Bhatia, 1988; Siddig, 1991). Certainly, agriculture in the Punjab did benefit significantly from Green Revolution technologies, but major farm output gains were not restricted to this state. Dak (1989) also found significant expansion in Haryana, Uttar Pradesh, Andhra Pradesh and Tamil Nadu, with each of these states having early and high exposure to Green Revolution benefits through farm mechanisation (Sharma, 1989). Of course, there were limitations on the effective spread of (some) Green Revolution technologies, for they relied heavily on irrigated farming systems, which inadequate water supplies militated against in some regions. However, the promise of biotechnological advancement is of less reliance on irrigated field systems (Buttel et al, 1985), so that even areas which did not see sharp increments in farm production following the Green Revolution could well experience substantial farm sector gains in the future.

In addition to which, the reader should be aware of the significance of non-farmer involvement in Punjabi farm-related manufacturing expansion. As Chapter Four made clear, the Punjab has long seen a division between its farm population, which is Sikh dominated, and its more urban dwellers, where there is a high proportion of Hindus (Rai, 1986, 1988). A much commented upon feature of economic advancement in the Punjab is the entrepreneurial strength of the Sikh population (Leaf, 1987). Yet the manufacturing expansion that followed on from agrarian growth in the state did not come from the farm community, nor indeed from the Sikh population. Thus, in the questionnaire surveys of manufacturing plants undertaken here, only 28% of plant owners were Sikhs. Far from relying on any peculiar entrepreneurship amongst the Sikhs, manufacturing growth was driven by Hindus, who form the majority of India's population.

This has broad relevance for industrial development within India, for here again the national government has taken measures to reduce inter-state disparities. For this, The State Financial Corporations and State Industrial Development Corporations were established in mid-1960s (Bajpai, 1985), with District Industries Centres created in 1977 in each district of India in order to help promote small-scale manufacturing growth (Vepa, 1988). One example of these promotions is seen in the expansion of small-scale agro-based manufacturing plants in Andhra Pradesh, for which large bank loans have been granted for developing rice processing and building flour mills (Reddy, 1990). However, while assistance has been given to small-scale processors in some states, it has to be borne in mind that the national government controls the location of large-scale manufacturing plants, along with trade in certain farm products. Maharashtra, for instance, is one of the most highly industrialised states in India, yet its agro-based manufacturing activity is insignificant, which might seem appropriate given that it has large areas of its farm economy under low yielding dry cultivation. However, on the other side, through developments during the colonial era, followed by tight government regulation over alternative locations thereafter, cotton textile production is a major industry in this state, yet there seem to be no notable links between local cotton cultivation and the location and output of yarn processing mills within the state (Sabade, 1987). For sugar-cane processing local ties between farm and factory are more obvious, yet the hand of government is even more evident in this sector, as factories are given the duty to generate (farm) supplies within their (government specified) catchment areas; and most processing activity is in (government controlled) large-scale factories. But it is perhaps for wheat that the hand of government over the geography of agro-based manufacturing is most evident (although fertilizer could be added as another significant sector). Here large quantities of farm output are processed prior to consumption (e.g. as flour, bread or pastry products), in much the same way as rice (although more wheat processing takes place within the home). Yet, unlike rice, which in the Punjab is processed prior to export, government control results in wheat being taken from the state in an unprocessed condition. What processing does occur elsewhere, so local manufacturing gains are lost. Whether manufacturing as a whole loses is a question that can only be posed. Certainly, if small-scale wheat processors spontaneously developed in a manner similar to that of rice shelling, then it is possible that more householders would make use of such local facilities (as they do for rice), rather than processing their own supplies. Irrespective of any possible overall losses under present government regulations, whether or not areas gain from manufacturing expansion in this way depends less on the performance of local agriculture and more on governmental (or political) decisions.

In general terms it is nevertheless true to say that the Punjab development experience shows that agricultural productivity can precede manufacturing development. This has been referred to as the Japanese development experience. As Mellor (1986, p68) noted: 'There are, of course, numerous examples of development practice that have indeed given agriculture a central place. Notable are the post-Meiji restoration period in Japan as well as development thrusts in Taiwan, Thailand, Ivory Coast, Malaysia, the Punjab's of India and Pakistan, and to some extent other parts of South Asia'. The Punjab development model is probably the most important confirmation that agrarian-led development is a possibility for economic improvement in Third World countries. Of course how appropriate this particular role for agriculture in economic development is, depends heavily upon the political system of a nation. As we have already seen, the potential for agrarian-led expansion in the Punjab is itself dependent on the character of governmental control. Across nations, the relative emphasis which public policy gives to agriculture, and the particular forms which agricultural policies take, must vary. Whatever the case, even amongst Third World nations, it is often argued that Asian economies are more sensitive to the performance of their agricultural sectors, as these have benefited more systematically from the rapid diffusion of Green Revolution technologies (Reynolds, 1985; Auty, 1995), so that the use of high-yielding varieties has been particularly successful in South and Southeast Asia (Ghatak, 1995). In very general terms, compared with Africa and Latin America, this point is understandable, given the comparatively high rainfall of Asian nations, which have the added benefit of relatively fertile land that is well suited to irrigation. Not surprisingly, therefore, for paddy rice yield and farm mechanisation, Asian countries have performed better than other Third World nations; which have often seen low rates of adoption of high yielding varieties (e.g. Arnon, 1981). For instance, from 1967 to 1994, paddy rice yield rose by 99.5% in Asia, 63.9% in Latin America and 49.1% in Africa, while during this period the number of tractors increased by 1,841.9% in Asia, 133.9% in Latin America and 56.9% in Africa (FAO, 1969, 1995).

Viewed in a more specific context, there are a number of nations which have experienced conditions of farm expansion with parallels to that of the Punjab. Thus, in each of China, Indonesia, the Philippines, Sri Lanka and Thailand, paddy rice output has seen phenomenal growth as a result of the adoption of high yielding crop varieties (Convey and Barbier, 1990; Otsuka, 1992). Thus, in the Philippines, there were no high-yielding varieties of paddy rice planted before the Green Revolution, but by 1968 they accounted for 21% of the total paddy rice area, with this figure having risen to 70.8% by 1980, which compares favourably with the position in Sri Lanka, where 71% of the paddy rice area was sown with high-yielding varieties at the beginning of the 1980s (Reynolds, 1985). Indicative of the potential for such growth to bring positive benefits for manufacturing, in rural Korea one of the most important production activities of small-scale manufacturing is rice shelling, with those regions that focused on paddy rice farming having a rice shelling share of total manufacturing activity of 42.3% in 1982 (Choe and Lee, 1985). Likewise, in the paddy rice sown areas of Thailand, rice milling is the highest income earner amongst activities in rural non-farm sector (Svetanant, 1985).

Significantly, the suggestion that the Punjabi experience can be (or is being) followed elsewhere does not have to rely on evidence of expansion in farm production that has followed on from the Green Revolution. Even prior to the Green Revolution, Falcon (1967) found that the crop flow to small-scale manufacturing in West Pakistan was more than five times that to large-scale agricultural processors. The growth impetus for small-scale manufacturing that Falcon observed was also found in the early years of the Green Revolution (the mid-1960s) in the Pakistan Punjab (Child and Kaneda, 1975). Here new fertilizer-responsive varieties of grain quickly raised wheat and paddy rice production, which resulted in a boom in small-scale engineering plants that supplied diesel engines, pumps and various other implements to the farm sector. This is despite the fact that few loan facilities have been approved for industries with agricultural linkages in Pakistan, like cold storage, poultry farming and rice milling (Harper, 1984). Moreover, focusing on the creation of small-scale farm machinery factories in Pakistan, Nabi (1988) concluded that their instigation was not a product of direct government intervention, yet a considerable proportion of Pakistan's manufacturing industry is dependent on sales of farm inputs (Malik, 1988).

What the comparison of the Punjabi and the Pakistan experience suggest is that the generation of agrarian-led (local) manufacturing expansion is not dependent on government encouragement. What it does rely on is the absence of government restriction, which includes availability of credit and other incentives for manufacturing expansion. Given this, there is the prospect of farm-led manufacturing growth elsewhere in the Third World.

Is Agriculturally-led Growth in Small-Scale Manufacturing Sustainable?

Sustainable agricultural growth is directly affected by ecological systems and environment factors in farm production areas. Only sustainable agrarian growth can maintain existing agro-based manufacturing in respective areas. For the future this raises important question marks over the sustainability of farm-led manufacturing production in the Punjab. This does not arise because substantial usage of fertilizer nitrogen (for wheat and rice) has polluted groundwater in the state, for this issue is not as critical as was once thought (Singh et al, 1987). Rather it is problematical because the water-table in the state is receding annually by an amount that averages one to one-and-half feet in the intensively cultivated areas of central Punjab (Sharma, 1994). The state's expert committee of agricultural scientists has suggested that a diversification of agriculture crops away from wheat and paddy rice to oil seeds is required to alleviate pressure on water supplies (Punjab Government, 1987). Yet, if Punjabi farmers do turn to oil seed farming, it is likely that similar gains (as for rice shelling activities) can be achieved for small-scale oil processing units. Alternatively, biotechnology could contribute immensely to sustainability through the protection and regeneration of the environment, partly from a reduction in chemical inputs, but more significantly by raising yields (Buttel et al, 1985; Ahmad, 1988; World Bank, 1991; Peters and Stanton, 1992). Whether biotechnology is introduced or not, there certainly seems to be substantial potential for greater paddy rice output in the Punjab, for a vast gap currently exists between farmers' yields and those obtained on research farms (with a mean average yield of 3,190 kilograms per hectare in the farmers' fields compared with 6,500 kilograms on experimental stations; Sharma, 1994). In terms of yield potential, therefore, there is still scope for further manufacturing growth in the Punjab that draws on farm product expansion.

What this suggests is that deliberate policy measures could be designed to enhance crop production and through this expansion in allied small-scale manufacturing. It certainly seems that sector-specific policies that stimulate agriculture and thereby small-scale manufacturing merit more attention from Indian policy makers. The opening of the large factories may be dramatic and politically attractive, or it may signify the attractiveness of an economy to foreign investors, yet the promotion of small-scale agro-based manufacturing would provide employment to rural and landless poor, and these employment opportunities would increase their income and thereby enhance their purchasing capacity for processed food (and other commodities). This could make a large dent in poverty levels in India; the need for which is clearly indicated in that, of the 1.13 billion people in the world who were regarded by the World Bank as being below the poverty line in 1990, 40% lived in India (The Economist Intelligence Unit, 1996). There is also a potential problem of output capacity rising beyond national demand.

This would not be a problem if foreign markets could be found (which is a possibility, given that recent GATT agreements have promised more capacity for exports from lower income countries). However, in a longer term, assuming that farm production growth occurs more universally in lower income countries, such gains might be challenged. Whether or not this is the case will partly depend upon demand growth (both in India and in other markets). What can be said is that, for the Punjab, in the past and in the short-term future, farm output growth has the potential to encourage manufacturing expansion.

Appendix I

Manufacturing Output Shares in the Indian States

The Manufacture of Agricultural Machinery and Parts
(percentage share of national production)

States	1979	1989
Andhra Pradesh	11.8	1.2
Assam	0.0	0.0
Bihar	2.8	1.9
Gujarat	11.0	2.0
Haryana	18.1	48.2
Karnataka	1.4	0.9
Kerala	0.0	1.0
Madhya Pradesh	0.0	0.5
Maharashtra	15.0	15.7
Orissa	0.0	0.0
Punjab	9.4	12.2
Rajasthan	3.2	2.2
Tamil Nadu	17.7	11.1
Uttar Pradesh	1.3	3.1
West Bengal	8.4	0.1

The Manufacture of Fertilizers and Pesticides
(percentage share of national production)

States	1979	1989
Andhra Pradesh	5.5	0.7
Assam	0.0	0.0
Bihar	3.3	4.2
Gujarat	20.5	24.0
Haryana	2.4	4.5
Karnataka	2.1	2.8
Kerala	5.2	6.4
Madhya Pradesh	1.6	1.0
Maharashtra	18.0	15.1
Orissa	0.0	6.6
Punjab	3.3	7.9
Rajasthan	6.2	3.8
Tamil Nadu	18.7	10.9
Uttar Pradesh	10.3	8.8
West Bengal	2.9	3.5

Note: Data are not available for 1969

Source: India Ministry of Planning (1969, 1979, 1989).

The Manufacture of Wool, Silk and Synthetic Fibres, and Jute, Hemp and Mesta Textiles
(percentage share of national production)

States	Wool, Silk, Synthetic		Jute, Hemp, Mesta	
	1979	1989	1979	1989
Andhra Pradesh	0.9	1.0	5.9	8.4
Assam	0.0	0.4	0.0	0.2
Bihar	0.1	0.2	1.8	1.7
Gujarat	22.3	26.2	0.2	0.0
Haryana	4.4	3.5	0.4	0.0
Karnataka	1.3	1.4	0.0	0.0
Kerala	1.4	0.0	0.0	0.0
Madhya Pradesh	5.1	4.5	0.1	1.0
Maharashtra	32.3	30.2	0.0	0.0
Orissa	0.0	0.0	0.4	1.2
Punjab	10.6	13.6	8.4	0.0
Rajasthan	7.9	10.1	0.2	0.2
Tamil Nadu	4.4	3.1	0.2	0.2
Uttar Pradesh	3.9	3.6	2.5	4.4
West Bengal	5.3	2.3	79.1	82.6

Note: Data are not available for 1969

The Manufacture of Wood and Paper Products
(percentage share of national production)

States	Wood Products			Paper Products		
	1969	1979	1989	1969	1979	1989
Andhra Pradesh	5.1	1.6	3.9	6.0	7.8	7.8
Assam	15.2	23.7	21.7	0.2	0.9	1.3
Bihar	0.2	2.1	9.0	4.3	4.1	1.1
Gujarat	3.3	4.8	5.5	3.7	7.2	7.9
Haryana	2.3	2.9	3.3	2.6	5.0	5.6
Karnataka	10.1	11.7	10.2	5.6	7.4	9.4
Kerala	10.2	13.3	9.0	7.1	4.8	4.6
Madhya Pradesh	1.0	6.0	4.9	7.5	6.3	4.6
Maharashtra	34.8	9.9	9.8	27.2	21.8	19.4
Orissa	2.1	5.3	4.0	6.3	5.2	3.6
Punjab	0.4	3.2	0.9	0.1	0.8	2.8
Rajasthan	0.0	0.2	0.8	0.3	0.7	0.7
Tamil Nadu	3.5	5.6	4.8	8.2	12.0	14.6
Uttar Pradesh	0.2	2.0	6.0	4.8	4.6	10.7
West Bengal	11.7	7.6	6.5	16.1	11.3	6.0

Source: India Ministry of Planning (1969, 1979, 1989).

The Manufacture of Leather and Rubber Products
(percentage share of national production)

States	Leather Products			Rubber Products*		
	1969	1979	1989	1969	1979	1989
Andhra Pradesh	0.0	1.3	3.6	0.0	3.3	5.1
Assam	0.0	0.0	0.0	0.0	2.2	3.8
Bihar	0.0	3.0	1.1	16.1	9.8	8.4
Gujarat	1.5	0.4	0.3	0.3	18.4	12.8
Haryana	0.0	0.2	1.9	5.2	2.0	1.5
Karnataka	0.0	0.5	4.0	0.0	0.7	1.7
Kerala	0.0	0.1	0.0	3.1	10.9	7.8
Madhya Pradesh	0.0	1.8	4.1	0.1	0.2	1.9
Maharashtra	5.5	3.3	4.8	41.1	19.8	22.7
Orissa	0.0	0.1	0.1	0.0	0.0	1.7
Punjab	0.0	6.2	1.9	0.4	2.9	1.2
Rajasthan	0.0	0.2	0.4	0.0	1.3	1.0
Tamil Nadu	70.5	56.6	50.5	9.3	14.6	13.7
Uttar Pradesh	16.0	11.5	16.3	0.2	2.6	10.0
West Bengal	6.4	14.8	11.0	24.4	11.4	6.6

*including Plastic, Petroleum and Coal Products

The Manufacture of Chemical and Non-Metallic Mineral Products
(percentage share of national production)

States	Chemical Products			Non-Metallic Mineral		
	1969	1979	1989	1969	1979	1989
Andhra Pradesh	4.8	4.9	5.6	7.7	7.2	11.0
Assam	0.0	0.5	0.3	0.1	0.7	0.6
Bihar	2.0	1.8	1.8	13.3	6.7	5.4
Gujarat	15.0	17.0	24.6	12.0	7.8	9.1
Haryana	0.2	1.2	2.0	2.9	4.0	3.4
Karnataka	0.9	3.5	3.0	6.2	5.6	6.8
Kerala	4.5	3.2	3.5	1.4	1.7	3.1
Madhya Pradesh	2.8	3.4	4.0	9.1	8.1	15.6
Maharashtra	45.2	38.8	28.1	10.8	9.8	11.6
Orissa	0.0	1.0	0.8	2.9	5.0	5.0
Punjab	1.5	0.1	3.4	0.0	20.2	0.4
Rajasthan	1.8	2.2	3.5	9.2	4.1	9.3
Tamil Nadu	5.4	10.6	7.7	14.7	10.3	9.4
Uttar Pradesh	4.8	5.6	6.9	3.3	4.4	6.5
West Bengal	11.1	6.2	4.9	6.5	4.5	2.7

Source: India Ministry of Planning (1969, 1979, 1989).

Production in Basic Metal and Alloys Industries,
and Manufactured Metal Products
(percentage share of national production)

States	Basic Metal and Alloys			Metal Products		
	1969	1979	1989	1969	1979	1989
Andhra Pradesh	1.1	2.3	3.3	0.5	2.2	5.9
Assam	0.1	0.1	0.2	1.0	0.4	0.4
Bihar	18.7	18.5	18.1	2.4	0.7	0.7
Gujarat	2.3	3.8	5.0	2.0	7.6	8.6
Haryana	1.7	3.8	3.3	4.5	7.7	3.5
Karnataka	1.5	4.9	3.2	2.0	3.6	3.9
Kerala	0.3	1.0	0.7	1.1	1.9	2.3
Madhya Pradesh	12.2	9.4	12.5	0.5	1.8	3.8
Maharashtra	14.6	15.2	14.4	42.7	40.0	39.4
Orissa	11.5	8.4	10.1	0.2	0.3	0.7
Punjab	1.4	6.3	4.8	2.0	5.7	5.3
Rajasthan	0.5	2.7	3.0	4.6	1.5	2.0
Tamil Nadu	4.2	4.2	4.7	5.4	7.2	8.4
Uttar Pradesh	5.6	6.0	6.4	6.9	6.4	8.0
West Bengal	24.6	13.5	10.2	24.3	13.1	7.2

The Manufacture of Machinery* and Electrical Machinery
(percentage share of national production)

States	Machinery			Electrical Machinery		
	1969	1979	1989	1969	1979	1989
Andhra Pradesh	2.7	4.2	3.8	5.3	10.0	13.3
Assam	0.3	0.1	0.1	0.0	0.2	0.1
Bihar	2.7	4.1	3.7	2.9	2.8	1.8
Gujarat	10.0	10.0	12.1	3.6	5.2	6.7
Haryana	8.2	10.1	9.8	2.6	2.9	2.8
Karnataka	4.7	4.8	5.1	11.6	10.9	12.5
Kerala	0.8	0.6	0.8	2.2	2.8	2.2
Madhya Pradesh	1.2	0.7	0.9	7.7	8.2	8.3
Maharashtra	34.3	29.7	26.0	30.2	24.4	20.9
Orissa	0.7	0.7	0.7	0.4	0.7	0.8
Punjab	1.3	3.3	3.3	1.8	1.7	2.8
Rajasthan	0.0	1.9	2.2	1.8	2.1	2.1
Tamil Nadu	15.5	17.3	17.8	7.5	5.6	6.1
Uttar Pradesh	2.5	3.8	8.6	4.0	10.0	11.9
West Bengal	15.0	8.9	5.1	18.3	12.4	7.7

*including machine tools and parts

Source: India Ministry of Planning (1969, 1979, 1989).

The Manufacture of Transport Equipment and Repair Services
(percentage share of national production)

States	Transport Equipment			Repair Services		
	1969	1979	1989	1969	1979	1989
Andhra Pradesh	1.4	2.7	1.5	6.4	10.0	6.7
Assam	0.4	0.0	0.1	1.0	0.1	0.8
Bihar	17.7	12.3	8.6	0.8	4.8	1.4
Gujarat	1.2	1.9	1.6	9.1	9.7	8.4
Haryana	3.4	4.1	12.7	0.6	1.2	6.9
Karnataka	2.9	4.1	3.8	10.0	8.1	3.9
Kerala	0.1	0.8	0.4	1.7	4.5	2.4
Madhya Pradesh	0.1	1.4	1.8	3.2	3.0	4.1
Maharashtra	22.1	28.9	33.0	20.6	22.5	28.3
Orissa	0.0	0.1	0.3	0.8	1.0	1.4
Punjab	2.8	6.2	6.8	1.1	3.7	2.1
Rajasthan	3.1	1.5	1.1	0.8	2.4	6.8
Tamil Nadu	17.4	17.7	14.3	32.4	16.1	17.5
Uttar Pradesh	6.2	5.3	5.9	6.7	7.2	6.5
West Bengal	21.1	13.1	8.3	4.7	5.7	2.8

Production of Electricity and Other Manufacturing Industries
(percentage share of national production)

States	Electricity			Other Manufacturing		
	1969	1979	1989	1969	1979	1989
Andhra Pradesh	6.0	5.7	6.8	7.1	5.7	2.0
Assam	0.8	0.3	0.0	8.3	2.5	0.1
Bihar	5.4	5.6	6.2	5.0	2.3	1.2
Gujarat	7.9	10.1	9.1	10.3	5.4	10.7
Haryana	2.6	1.2	2.8	3.1	9.2	1.7
Karnataka	6.0	5.6	4.2	5.4	6.8	11.5
Kerala	2.9	3.1	1.6	12.8	2.8	2.6
Madhya Pradesh	4.8	5.2	0.1	0.9	1.2	2.5
Maharashtra	19.2	21.2	23.7	12.6	33.3	29.2
Orissa	1.7	1.6	2.8	6.9	0.3	0.9
Punjab	0.0	5.6	4.3	8.0	3.1	3.1
Rajasthan	2.8	7.2	4.9	3.0	2.5	3.1
Tamil Nadu	13.5	9.8	10.2	4.3	5.4	8.1
Uttar Pradesh	10.8	9.2	14.2	2.9	7.6	14.7
West Bengal	15.6	8.5	9.2	9.5	12.0	8.7

Source: India Ministry of Planning (1969, 1979, 1989).

Appendix II

Punjab State Industrial Policies

1. Punjab Government Industrial Policy, 1978.

The following industries are not eligible for incentives: flour milling, rice shellers, cotton ginning, the manufacture of bright bars, wires of mild steel, cold storage, re-rolling steel, ice plants, oil crushing other than solvent extraction plants, printing presses, candle making, servicing units, repair shops, handloom weaving, heat treatment and electroplating.

The following are the priority industries for incentives: electronic instruments/components, industries based on agricultural waste such as wheat and paddy straw and husk, cotton spinning and weaving (medium/large-scale sector), insecticides and pesticides (Punjab Directorate of Industries, 1977).

2. Punjab Government Industrial Policy, 1987, 1989, and Package of Incentives, 1992.

The following industries are not eligible for state capital subsidy and sales tax incentives : rice mills, pulse and cereal mills, spice mills, flour mills, cotton ginning, photographic studios, manufacture of ice, laundries, tailors, confectionery plants, frying of edible oil, re-rolling of steel, wire drawing of steel and stainless steel, wires and cables (aluminium), bright bars, the paraffin wax based industry, power intensive units (electrothermel, electrochemical), bricks/tiles production excluding ceramics tiles, the manufacture of stainless steel products (domestic, wiper blades, hospital equipment, watch straps), the cement based industry and hotels.

The following districts are the priority areas for incentives: Amritsar, Bhatinda, Ferozepur, Faridkot, Gurdaspur, Hoshiarpur, Rupnagar, Sangrur and the Rajpura tehsil of Patiala (Punjab Directorate of Industries, 1986, 1988, 1992).

Appendix III

Data Collection and Survey Experience

For the questionnaire survey, personal visits were made to the rice shellers and agricultural machinery manufacturing units in Jalandhar and Kapurthala districts. A number of difficulties were experienced during the course of survey. In selecting the samples for these surveys, the information that was available at the District Industries Centre were not organised in such a way that there is an easily identifiable list of small-scale factories in a district. It is not simply that there was no computer print-out, for even the idea of keeping records according to type of manufacturing unit had not been taken on board in these offices. Instead, what they maintained were yearly record books with all types of manufacturing plant arranged in any order. In fact, these books were so carelessly kept that sometimes even the writing in them was not clear enough to understand. Some books were held in a store with heaps of things lying here and there (e.g. broken furniture, etc.). Tracing a record book in that store was equally problematical (or at least discomforting), for nobody in the offices willingly wanted to fetch the books from the store owing to the difficulty of finding them and the amount of dust and dirt that covered them. Eventually, they allowed me to search for each yearly record book and bring them out to be examined. Then, for agricultural machinery units I had to search all records for a list of names and addresses, as the files did not distinguish factories by product. Fortunately, this task was easier for rice shellers, as the list of all rice shellers (including their address) was available in the District Food and Supplies Department offices.

During my field work, it was found that most of the agricultural implements manufacturing units did not keep full financial accounts. The factory owner was the only reliable source from whom I could get detailed information on plant production levels. As a result, if he was not found to be available, I had to pay repeated visits to the factories and even sometimes to the residence of the owner. However, the procedure was different for rice shelling. Here, financial accounts were available which provided production information. Not unexpectedly, they (accountants) did always hesitate about giving away any information without the owner's permission (to some extent this was for income tax purposes). In these cases, I often had to wait for long periods of time in order to complete interviews, which always disturbed my daily schedule. Nevertheless, apart from the delays caused by having to find or fetch the factory owners, the interviewees were always very cooperatives and gave me a great deal of their time (as I always took a long time to discuss other things with them, such as marketing arrangements, government policies, etc.).

An additional inconvenience that I experienced during my survey period arose due to the disturbed political conditions of the state. These problems also occurred on my first research visit to India, when I went to collect the information on manufacturing activity from the unpublished files at the Punjab Directorate of Industries. During both stays, a curfew was imposed every second or third day and sometimes this lasted for a number of weeks. This is not the only problem affecting the data collection and the survey work which resulted in research for the thesis taking longer than expected. Problems were also faced while collecting data from unpublished files at the offices of the Punjab Directorate of Industries in Chandigarh. This arose partly because I was the first researcher to visit these offices who asked for detail information on large/medium-scale industries in the state. The organisation of the data in the office was not geared toward providing this information. Instead, they had lengthy individual accounts on each manufacturing plant. Consequently, I had to examine detailed files on all 125 agro-based large/medium-scale factories in the state for every year from 1980. This involved searching the files for data on capital investment, working capital, employment levels, annual production volumes, sales inside the Punjab, sales outside the Punjab, raw material consumption, etc. In reality, searching through these unpublished files was as time consuming as the questionnaire survey work that was undertaken.

As a further data source for the study, lengthy and detailed interviews were undertaken with various government officials in the Punjab Directorate of Agriculture and Industry, the Punjab Food and Civil Supplies Department, the Regional Office of Food Corporation of India, the Punjab Agro Industries Corporation, the Punjab Financial Corporation, the Punjab State Industrial Development Corporation, the North India Technical Consultancy Organisation, the Regional Rice Research Centre Kapurthala, and various other organisations representing large/medium and small-scale manufacturing units (the intention was to gather information on all aspects of private and public involvement in the state's agricultural and industrial sectors). Interviews were also conducted in the head offices of the state's large/medium-scale fertilizer manufacturing plants.

As a final world of advice for any researcher seeking to undertake a project on the Punjab from Britain, I would advice that planning is made for several visits to the state. Even for secondary data I found significant difficulties in obtaining the information I required. Statistics on the Punjab (or other Indian states) were not readily available in London in the detail that I required (or on annual basis). Letters send to government offices in the Punjab usually did not meet with a reply. Friends and family members were able to purchase or obtain some data for me, but this could not be complete, as it was often unclear what information was available or how it could be obtained (and, as the many weeks I spent examining unpublished files in government offices indicates, often the data are not readily available in any case). As such, one research visit to collect the data that are required to make decisions about survey sites, etc., would seem advisable before undertaking questionnaire work.

Appendix IV

Questionnaire

CONFIDENTIAL

SURVEY OF RICE SHELLERS AND AGRICULTURAL MACHINERY PLANTS IN JALANDHAR AND KAPURTHALA DISTRICTS

Date:

1. Name of the factory

2. Location

3. (a) How many employees are working in this factory at the present time?

(b) What percentage of these employees are farmers?

4. (a) Who owns this factory?

(b) (If a company): What is the name of the company?

5. Where is the head office of the factory/company?

6.(a) (If a company): Is this factory a private sector company, owned by the public sector or a joint public/private venture?

(b) (If a private company): Is the factory owned by a single person or a partnership?
(If a public/private venture): Is the factory owned by a cooperative or shareholders?

(c) (If a single person or partnership): Is this factory, the sole, primary or secondary source of income for the owners?

(d) (<u>If the primary or secondary income source</u>): What are the other sources of income for the owners?

(e) (<u>If agriculture</u>): How many acres does the owner/partner farm?

7. In what year was this company established?

8. In what year did your company start production in this factory?

9. (a) (<u>If the company was established before it started production in this factory</u>): Where did production take place before the factory moved to this site?

(b) (<u>If elsewhere</u>): Is this other factory still manufacturing products for your company?

10. (When your company started production or moved to this factory):
    (a) Was the factory newly built?

(b) (If yes): Why did your company build a new factory?

(c) (If no): What did this factory produce before your company started production on this site?

(d) (If no): Why did your company buy an existing building or an established factory?

11. (<u>If this factory started production after 1980</u>): What were the main reasons of choosing this site for the factory?

12. When this factory was built/bought, what percentage of the money required to pay for it came from:

	Percentage
(a) The company/owner funds	
(b) Bank loans	
(c) Loans from Co-operatives (agricultural or industrial)	
(d) Government (subsidies or loans)	
(e) Family	
(f) Others (foreign remittances, etc.)	

13. (a) What are the finished products of this factory?

(b) (<u>In the last 12 months</u>): What percentage of the sales revenue of this factory came from each of these products?

(c) (<u>In the last 12 months</u>): What percentage of sales were made within the Punjab for each of these products?

	(a) Product	(b) Percentage	(c) Percentage
(i)			
(ii)			
(iii)			
(iv)			
(v)			
(vi)			

14. What percentage of the sales of these products are made to:

	Percentage by product					
	(i)	(ii)	(iii)	(iv)	(v)	(vi)
(a) Other branches of this company (% within the Punjab)						
(b) Other manufacturers						
(c) Wholesalers						
(d) Retailers						
(e) Farmers						
(f) Government agencies						
(g) others (please name)						

15. (a) Has the type of finished product made in this factory changed in the last 5 years?

(b) (If yes): What are the main reasons for these changes?

16. (a) Has the volume of production of this factory changed in the last 5 years?

(b) (If yes): What are the main reasons for these changes?

17. (a) Has the percentage of this factory's produce sold in the Punjab changed in the last 5 years?

(b) (<u>If yes</u>): What are the main reasons for these changes?

18. (<u>If production has expanded in the last 5 years</u>): What percentage of the funds required for expanding production in this factory came from:

	Percentage
(a) Company/ owner funds	
(b) Banks	
(c) Co-operatives (agricultural or industrial)	
(d) Government (subsidies or loans)	
(e) Family	
(f) Others (foreign remittances, etc.)	

19. (a) What are the main materials consumed in manufacturing in this factory (excluding energy)?

(b) (In the last 12 months): What percentage of material costs came from each of these commodities?

(c) (In the last 12 months): What percentage of the cost of each of these materials is purchased within the Punjab?

	(a) Material	(b) Percentage	(c) Percentage
(i)			
(ii)			
(iii)			
(iv)			
(v)			
(vi)			

20. What percentage of the material costs for these commodities are purchased from:

	Percentage by material					
	(i)	(ii)	(iii)	(iv)	(v)	(vi)
(a) Other branches of this company (% within the Punjab)						
(b) Other manufacturers						
(c) Wholesalers						
(d) Traders						
(e) Permanent contracts with farmers						
(f) Direct purchases from farmers (not under contracts)						
(g) Farm markets (owner's purchase)						
(h) Agricultural marketing agencies						
(i) Other sources (please name)						

21. (a) Have the type of materials used in this factory changed in the last 5 years?

(b) (<u>If yes</u>): What are the main reasons for these changes?

22. (a) Other than any new materials, has the percentage of each material used in manufacturing in this factory changed in the last 5 years?

(b) (<u>If yes</u>): What are the main reasons for these changes?

23. (a) Has the percentage of materials purchased within the Punjab changed in the last 5 years?

(b) (<u>If yes</u>): What are the main reasons for these changes?

24. Have you considered (further) expanding production in this factory?

(a) (<u>If yes</u>): What are the main reasons why expansion has not occurred?

(b) (<u>If no</u>): What are the main reasons for not considering expansion?

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